WATER WORKS & SEWERAGE

HBP ABC

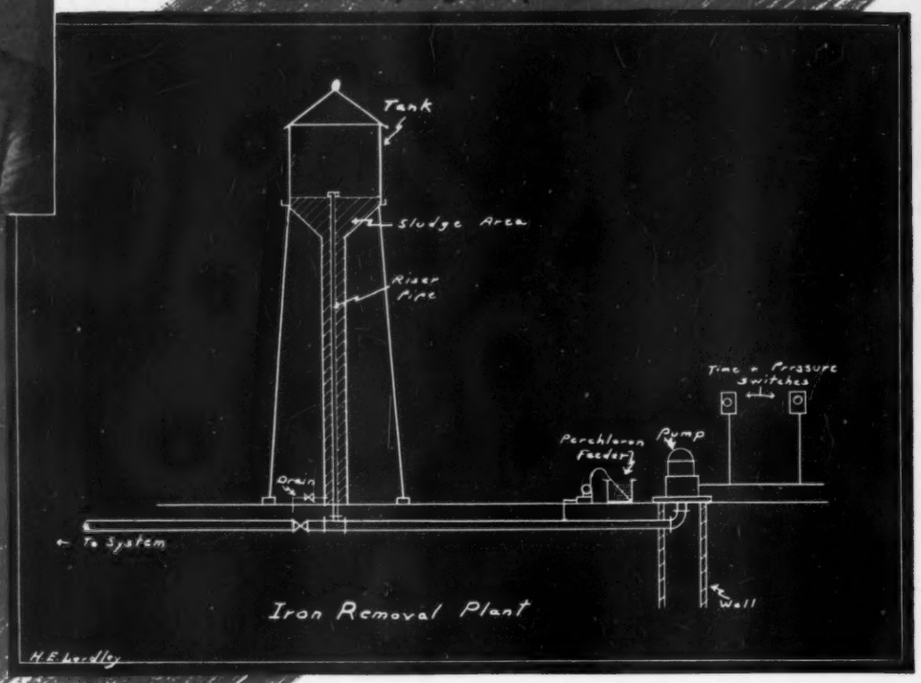
OPERATING FLOOR—TOLEDO'S NEW 80 MGD FILTRATION PLANT

Perchloron does three important jobs in Virginia . . .

REG. U.S. PAT. OFF.

1. Sanitizes water at "a few cents per million"
2. Oxidizes ferrous iron in water
3. Removes hydrogen sulphide

H. E. Lordley, Plant Manager



According to Mr. H. E. Lordley, a waterworks engineer in Virginia, Per*chlor*on proved an unusually valuable source of chlorine by doing triple duty in a small community near Richmond. Here's Mr. Lordley's Per*chlor*on case history in his own words:

"Many of the deep-well supplies serving small communities in eastern Virginia not only show bacterial pollution but also have hydrogen sulphide and ferrous iron. In one case, the well water had an iron content of 6 p.p.m. plus hydrogen sulphide which precipitated as iron sulphide in the distribution system, and customers received black water.

"On investigation, I found that a simple treatment of only 3 p.p.m. chlorine would oxidize the iron, remove the hydrogen sulphide, and deliver a sterile water having a residual chlorine of 0.20 p.p.m. Since it was not practical to use liquid chlorine on such a small supply, Per*chlor*on was used, and the solution was fed into the system by a Chlor-O-Feeder.

"The water consumed by the system after ten p.m. was negligible, so that the pump and feeder could both be started by a time clock every night, and all the water was then pumped into the storage tank. In this tank, the riser pipe extended about five feet above the bottom, so that the oxidized iron and sludge settled to the bottom of the tank and were drawn off through a waste valve once a week. By five a.m. the water had settled, and the clear water flowed to the customers with no hydrogen sulphide, no bacteria, and only 0.5 p.p.m. iron as ferric oxide, all without the aid of filters.

"Here Per*chlor*on did three big jobs, and the community received safe water for only a few cents per million."

Per*chlor*on, with 70% available chlorine, is readily dissolved, keeps well and offers you an excellent stand-by source of chlorine. It comes in handy 5-lb. cans with airtight covers, 9 to the case; and in 100-lb. drums. Write Dept. WS for *free* illustrated booklet.

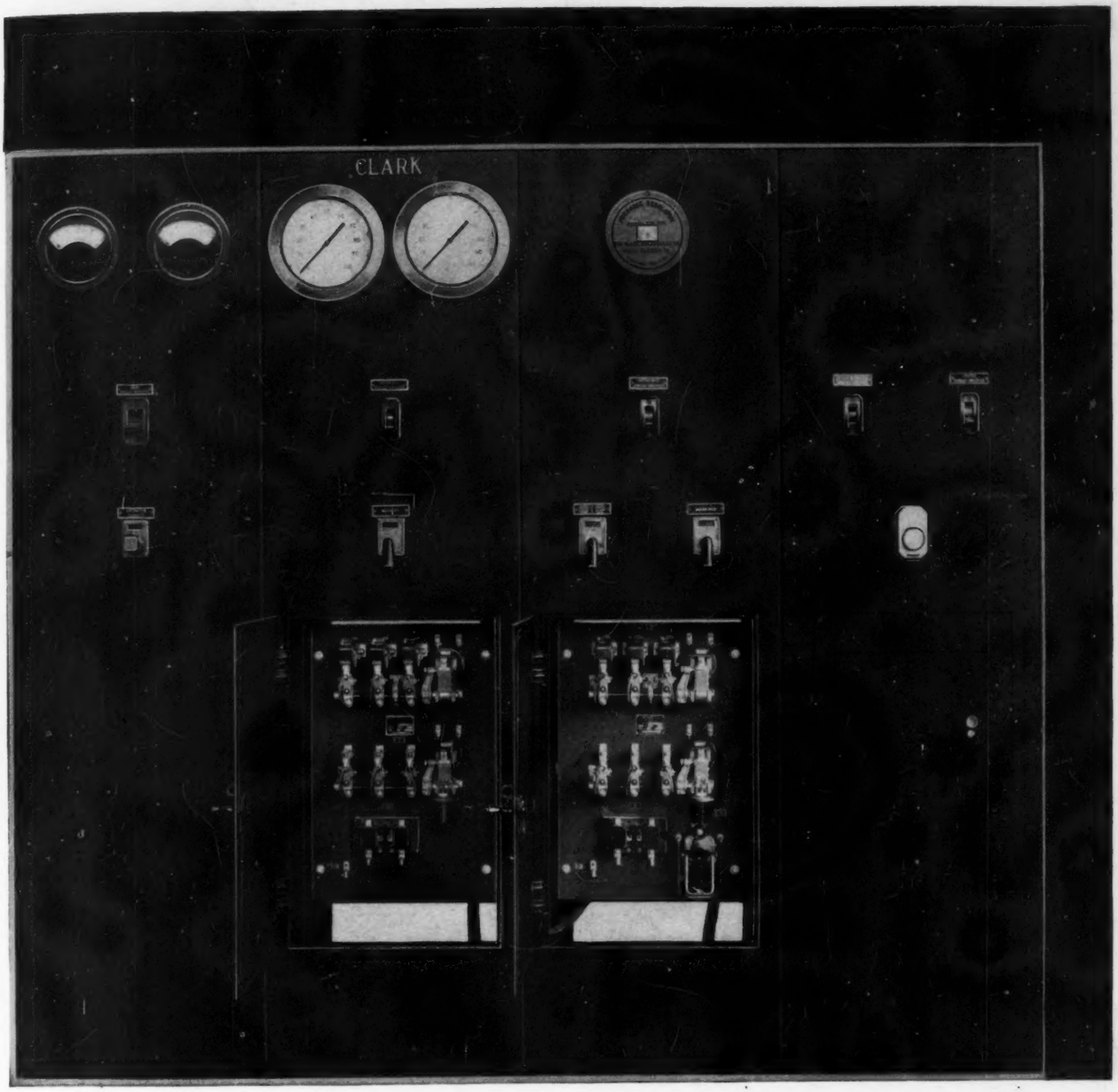
Per*chlor*on is, of course, being used for direct defense purposes and is being supplied regularly to the Government. While this makes it impossible for us to deliver normal quantities to our customers, we want you to know the facts, believing that you will cooperate with us by ordering only your immediate needs. We hope too that you will avail yourself of the services of the Penn Salt representative nearest you who may be able to help you in meeting today's unusual problems.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

1000 WIDENER BUILDING, PHILADELPHIA

New York • Chicago • St. Louis • Pittsburgh • Wyandotte • Tacoma



This completely enclosed dead front steel panel type of enclosure is used to control two pumps which boost the regular water supply into a 1,000,000 gallon standpipe at an Eastern Airport. The boost is normally about 60 ft. The equipment includes electrical and hydraulic indicating gauges, circuit breaker protection for all circuits and a single pressure regulator which will allow either pump to operate automatically. The starters are "3C" Edgewound resistor type, the resistors being behind the slate panel shown in the photograph and they are readily accessible, although unseen, because the panels are equipped with swing-out features. The door on the right-hand panel encloses a lighting circuit breaker distribution panel and the room thermostat controls electric heaters, which keep the pumping station above freezing.

"3C" Engineers are at your service in Water Works and Sewage Plant pumping control problems.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

WATER WORKS & SEWERAGE, April, 1942. Volume 89. Number 4. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada, $2.00 per year; Foreign $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

74 YEARS OF CONTINUOUS OPERATION

and STILL GOING STRONG!

◆

That's Some Record Gentlemen!

THERE ARE NO PRIORITIES ON PROGRESSIVE THINKING!

IN times of emergency, such as these, there is little incentive or opportunity for the average manufacturer to develop new lines or to build improvements into existing products. A generally oversold condition, coupled with unprecedented wartime demands, is not conducive to immediate progress within the equipment industry. It does provide, though, an opportunity for some good solid thinking on what can be done when the emergency is over.

The Engineering, Research and Development Departments of the Pittsburgh-National organization are thinking ahead of the times. On the drawing boards new designs are taking form. In the laboratories, experimental models are being put through their paces. Scarcity of materials and priority controls will prevent the immediate introduction of these developments. *But there are no priorities on progressive thinking.* With the ultimate return to normal, the results of today's research will be apparent in tomorrow's equipment.

The Pittsburgh-National organization, with its unexcelled facilities for research and development, including fellowships at a world renowned scientific institute, have contributed valuable aids to the Nation's defense efforts.

In peace or at war, continuous research goes forward to assure that the technical developments of the future, be they designs, materials or methods, will be incorporated in the products of the Pittsburgh-National line.

PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · BROOKLYN · DES MOINES · MEMPHIS · OAKLAND · TULSA · CHICAGO · BOSTON

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Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

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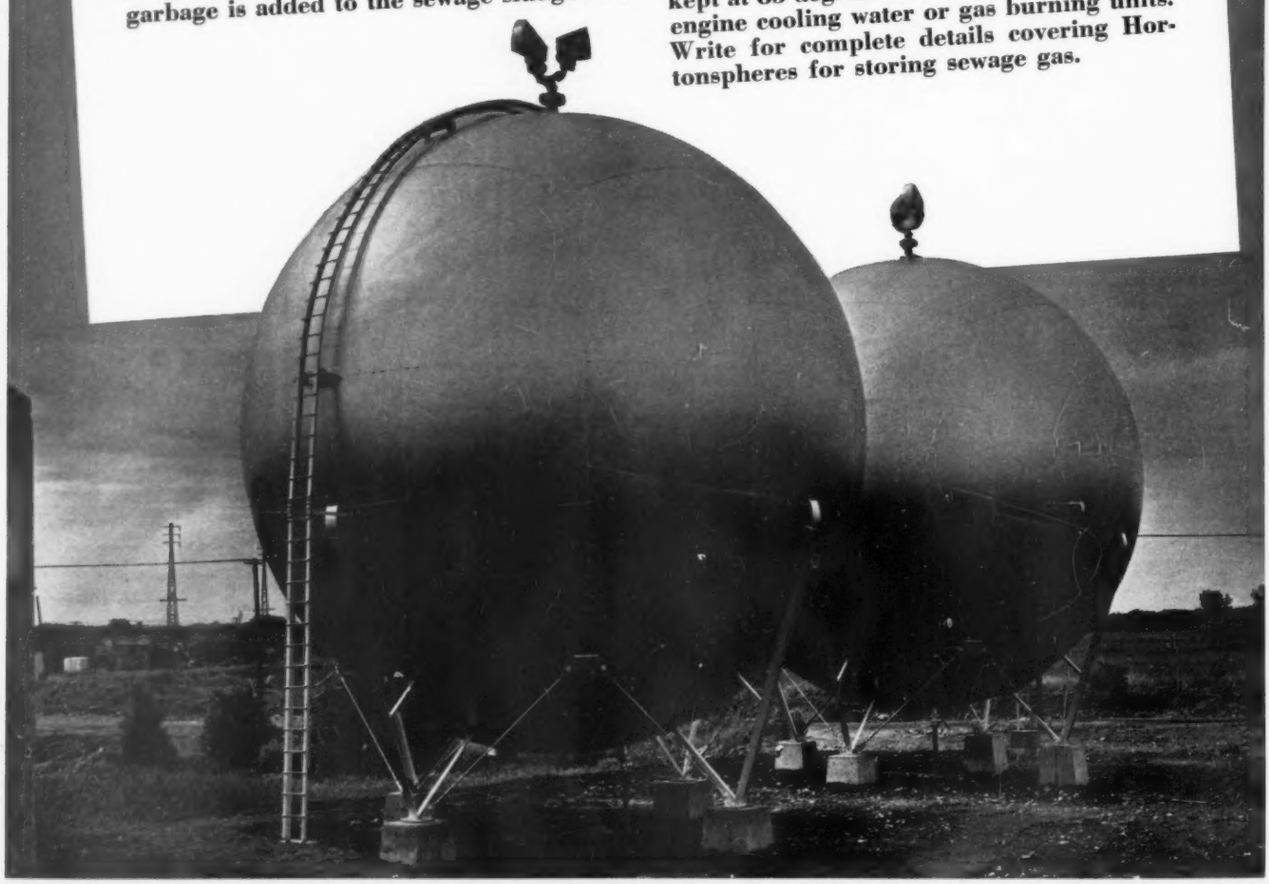
THE MOST COMPLETE LINE OF [illegible]

2 HORTONSPHERES
used at the Rock Island sewage plant for HEAT and POWER requirements

THE sewage disposal plant which was completed in 1940 at Rock Island, Ill., included the installation of new storm and intercepting sewers, pumping equipment, a sewage and garbage treatment plant and incinerators for refuse and sewage sludge. Seven gas engine-driven pumps and four electric pumps are employed; the gas engines providing power for all pumping, the electric units being used for stand-by service.

The digestion process produces 1 cu. ft. or more per capita of 650 Btu gas. Ground garbage is added to the sewage sludge as a means of disposal and to increase the gas output. The two Hortonspheres shown below provide an adequate reserve of gas to supply the heavy pumping demands during storms. They have a capacity of 50,000 cu. ft. each and operate at 50 lbs. per sq. in. pressure. This utilization of gas provides normal heat and power needs, thus releasing power generating capacity to supply manufacturing industries for war production. A small gas engine generating unit furnishes electricity for lighting and other electrical equipment. Incinerators will operate on gas, while the digesters are kept at 85 deg. and the buildings heated by engine cooling water or gas burning units. Write for complete details covering Hortonspheres for storing sewage gas.



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New York.3390 165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington...632 Washington Bldg.
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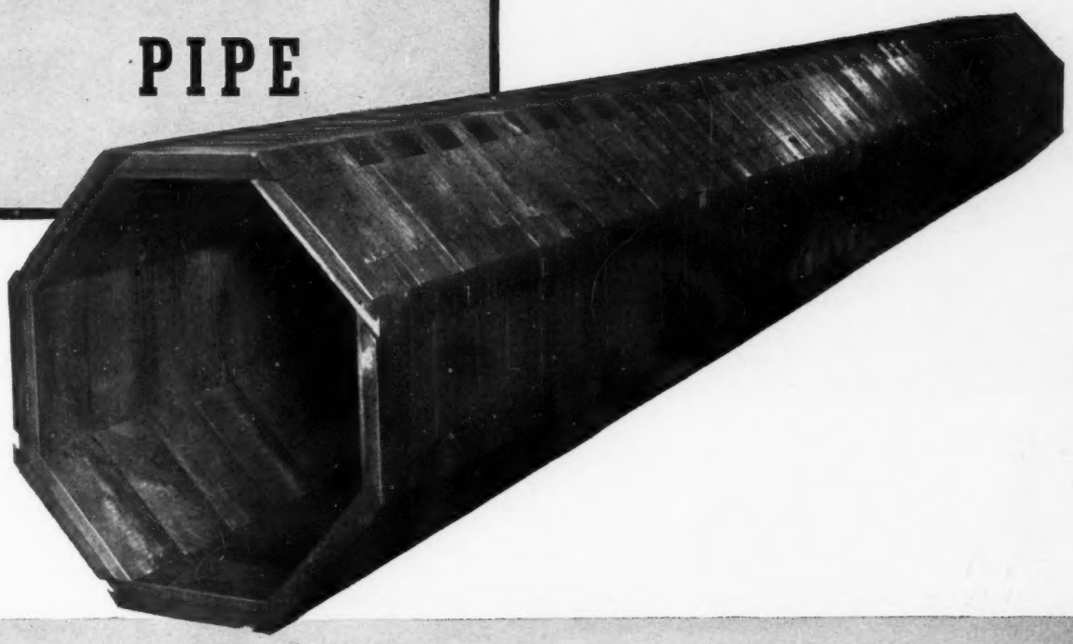
Plants at BIRMINGHAM, CHICAGO, *and* GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

NEW EMERGENCY PIPE



Solves War-Time Drainage Problems

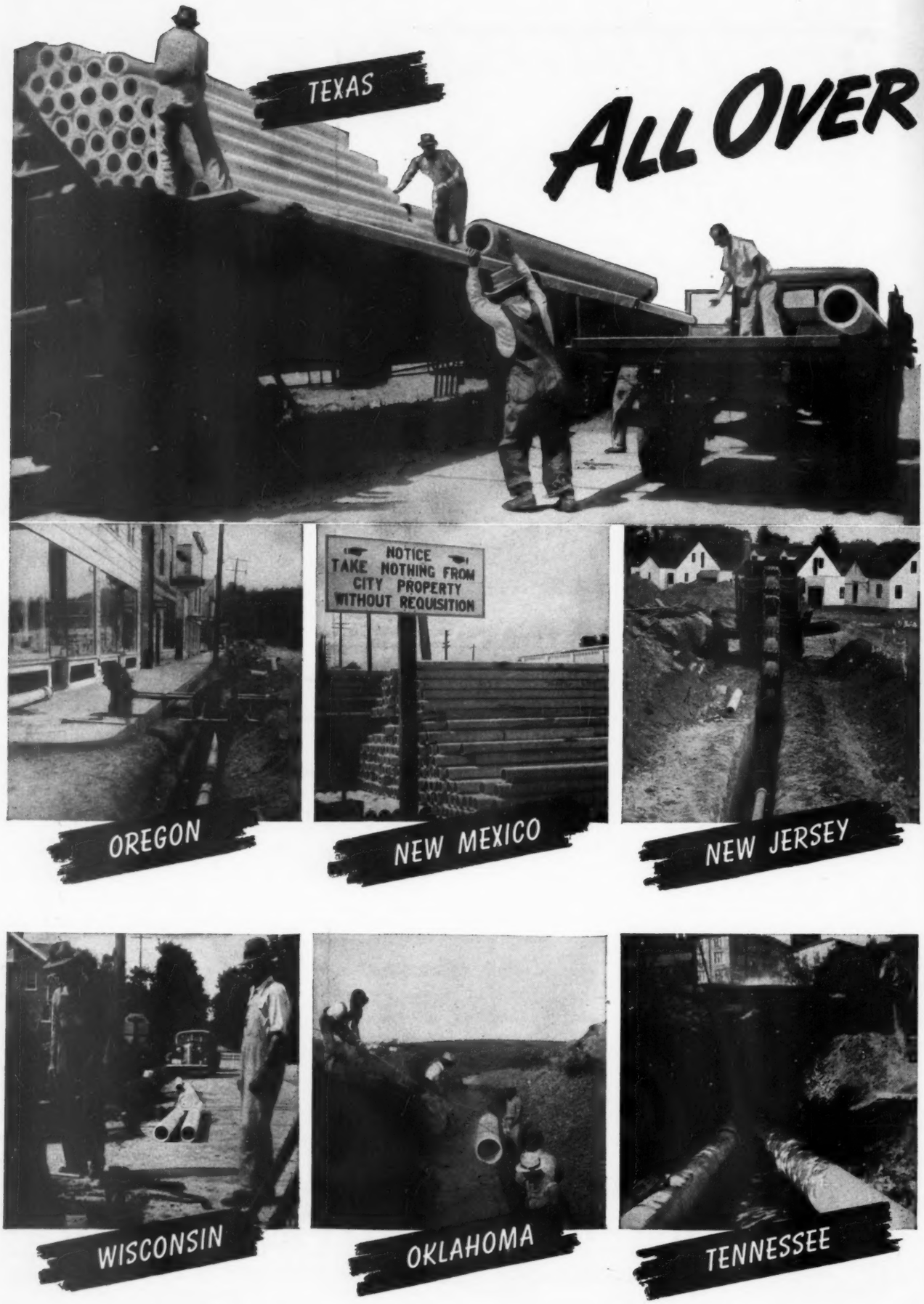
Steel, a critical war material, must not be used in any drainage structure except where engineering integrity demands it. Yet here is a practical war-time substitute. It's the ARMCO Emergency Pipe, designed by a drainage engineering organization with 38 years' experience.

This completely new design in wood drainage structures meets war-time emergency requirements. Steel bands, metal reinforcing or other critical materials are not required. The semi-flexible design provides ample strength to meet engineering standards. Yet this Emergency Pipe is light in weight for easy handling. Installation cost is low. There is no field assembly except joining long sections of any length that can be hauled and handled. Skilled labor is not needed.

On the durability side ARMCO Emergency Pipe performs admirably as a war-time structure. It goes "all-out" in meeting the War Production Board's requirements for substituting non-critical materials wherever possible.

Use the ARMCO Emergency Pipe for essential culverts, storm sewers, underpasses, conduits or wherever else drainage structures are needed and vital materials must be conserved. Your request will bring complete information. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 425 Curtis St., Middletown, Ohio.

ARMCO EMERGENCY PIPE


TEXAS
ALL OVER
OREGON
NOTICE
TAKE NOTHING FROM
CITY PROPERTY
WITHOUT REQUISITION
NEW MEXICO
NEW JERSEY
WISCONSIN
OKLAHOMA
TENNESSEE

THE COUNTRY!

In hundreds of communities, J-M Transite Pipe is providing more efficient water transportation at lower cost. *Here are the reasons why—*

Easy to Handle, Transite is light in weight, comes in 13-foot lengths. Except for the largest sizes, no mechanical equipment is needed.

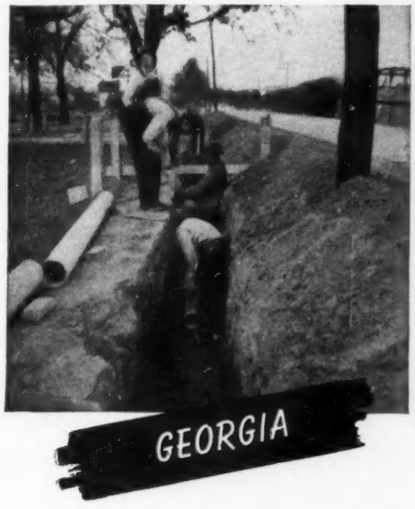
Rapid Assembly is assured by the Simplex Coupling, a pre-fabricated, "packaged" joint that eliminates heating or pouring. Unskilled crews can form tight joints quickly, easily.

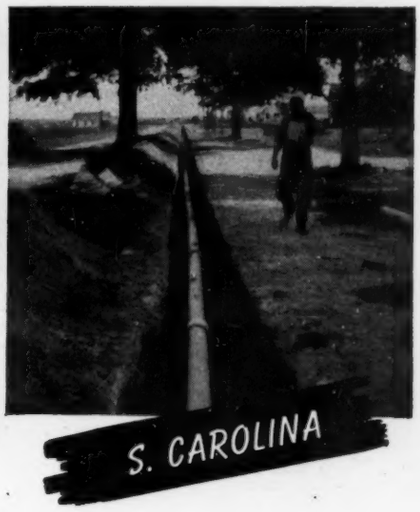
Tuberculation Is Impossible because Transite is made of asbestos and cement, non-metallic. Its initial high flow-coefficient (C=140) can never be reduced by tubercles.

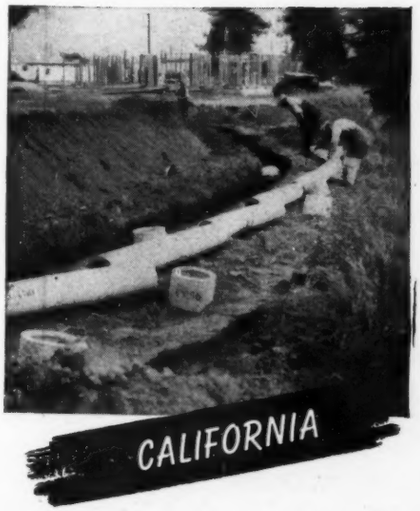
High Corrosion-Resistance is another feature of Transite's asbestos-cement composition.

Joint Leakage Minimized by the tightness and flexibility of the Simplex Coupling. This modern coupling allows deflections of as much as 5° at each joint . . . permits wide sweeps to be laid with straight lengths of Transite.

For details on Transite Pipe for water lines, write for brochure TR-11A. And for information on Transite Sewer Pipe for lower cost sewage-disposal systems, write for brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.







Johns-Manville

TRANSITE PIPE

An Asbestos Product for More Efficient, Economical Water & Sewer Lines

Pacific Clipper over starting point of its World Flight.

Everdur FLIES WITH PACIFIC CLIPPER ON HISTORIC WORLD FLIGHT

CAUGHT in the midst of total war in the Far East, the crew of Pan-American Airways' Pacific Clipper thrilled the world by bringing the 42-ton craft safely to New York. They rounded the globe to do it and won themselves a niche in the aerial Hall of Fame. Many fluid and hydraulic lines that served these hardy navigators were made of dependable Everdur*, the copper-silicon alloy which does yeoman work for other U. S. planes in war or peace.

The same properties of great strength, corrosion-resistance and toughness that have made Everdur an ideal engineering material for water works and sewerage construction, are being utilized to the limit by the armed services of our nation . . . as fuel, oil and high-pressure hydraulic lines in aircraft . . . for non-rust construction in the Navy and Merchant Marine. Everdur thus is playing an important part in the task of making our Army, Navy and Air Force the mightiest on earth. 42272A

Mechanic checking union of Everdur Metal line in de-icer mechanism on Clipper engine.

*Everdur is a trade-mark of The American Brass Company Reg. U. S. Pat. Off.

Everdur COPPER-SILICON **Metal**

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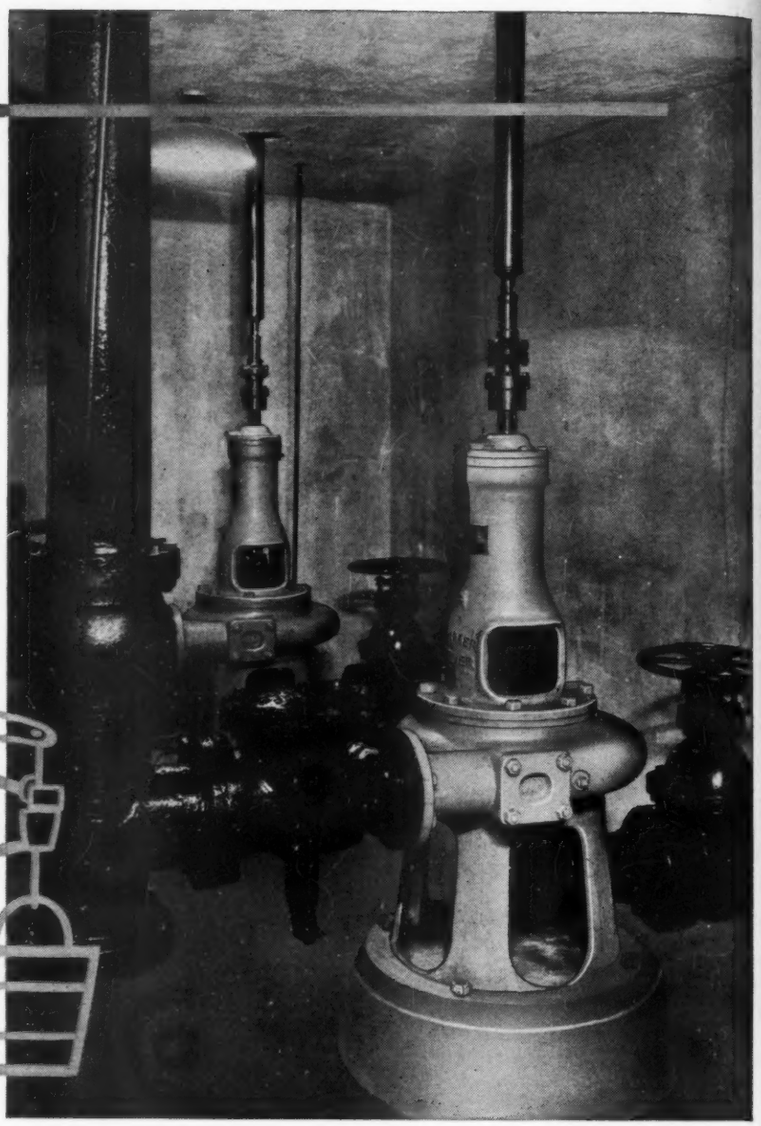
THE unfailing purity and dependable uniformity of Diamond Liquid Chlorine safeguard your water treatment. From our centrally located plant at Painesville, Ohio, scheduled shipments are made in cylinders or cars according to your requirements.

For complete satisfaction, standardize on Diamond!

DIAMOND ALKALI COMPANY

PITTSBURGH, PA., AND EVERYWHERE

DESIGNED FOR THAT *Extra* LOAD



IN MANY a community today, increased industrial activity puts an extra load on sewerage facilities. Such conditions emphasize the need for truly modern sewage handling equipment, with the ability to handle peak loads and additional capacity. Gardner-Denver Sewage Disposal Pumps are truly *modern*. Modern in their ability to operate at higher efficiencies—modern in their many refinements of mechanical and hydraulic design. They are modern, too, in their low horsepower requirements—their ability to lower operating costs per thousand gallons pumped.

Gardner-Denver Sewage and Waste Disposal Centrifugal Pumps are ruggedly built, and have a minimum number of wearing parts. Incorporating the latest technical improvements and features of design, they meet today's conditions. For complete specifications, write to Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER PRODUCTS KEEP SPEED IN VICTORY

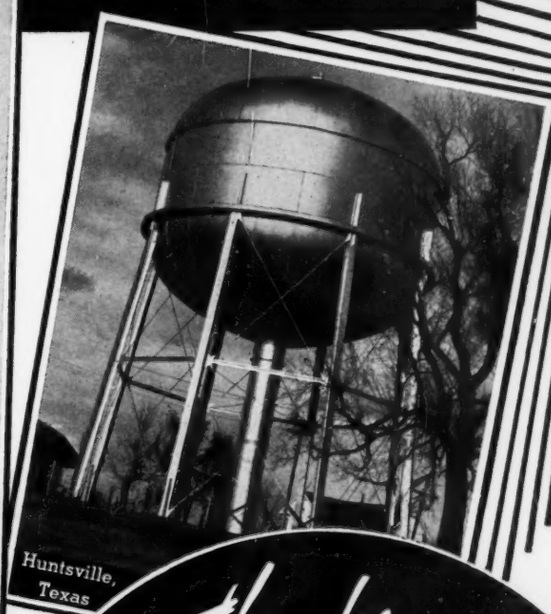
GARDNER-DENVER *Since 1859*

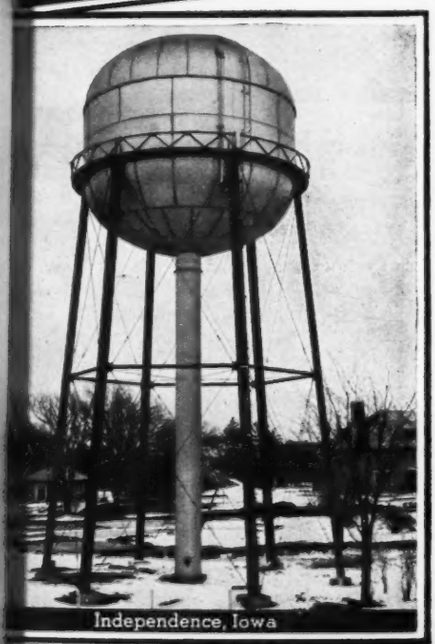
Recent additions to the long list of municipalities enjoying...

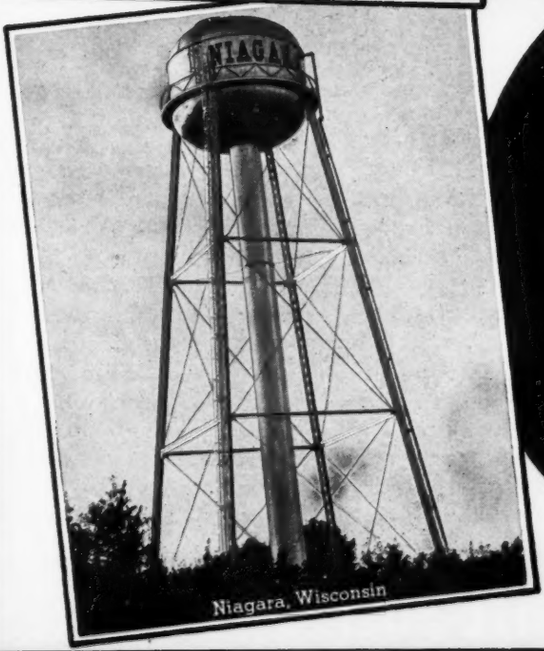
UNIFORM PRESSURES
AMPLE SUPPLY AT PEAK DEMAND
UNINTERRUPTED SERVICE

Jennings, Louisiana

St. Joseph, Missouri


Huntsville, Texas


Independence, Iowa



Niagara, Wisconsin

-thanks
TO MODERN WATER STORAGE BY
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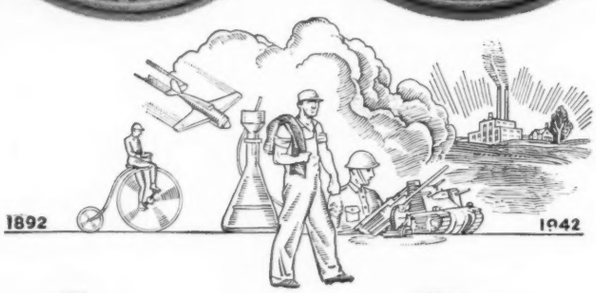
fifty years of Mathieson Chemicals



An American Pioneer FACES THE FUTURE

● Fifty years ago, when Mathieson was established, all of the bleaching powder and most of the alkali used in this country were imported from England. Since 1892, when Mathieson began pioneering the domestic manufacture of these and other products, its original plant at Saltville, Va., has grown into three modern manufacturing units covering hundreds of acres of ground.

In the laboratory, in the plant and in the field, Mathieson chemists and engineers have been leaders in research and in the development of new products . . . in the adaptation of both new and old products to more efficient use in industry . . . in the modern transportation and low-cost distribution of chemicals direct to the consumer.

Today, the towering stacks of three great Mathieson plants are dynamic evidence of a half century of progress in the production and distribution of quality chemicals. Strategically located at Saltville, Va., Niagara Falls, N.Y., and Lake Charles, La., these three manufacturing units are in a position to serve consumers of alkali and chlorine products throughout the chief industrial areas of the country.

In 1942, on its 50th Anniversary, The Mathieson Alkali Works is proud to rededicate its plants and personnel to a nation at war . . . confident that the vision and initiative which have made America strong will win through to victory.

MATHIESON CHEMICALS

CELEBRATING FIFTY YEARS OF SERVICE TO AMERICAN INDUSTRY AND PUBLIC HEALTH

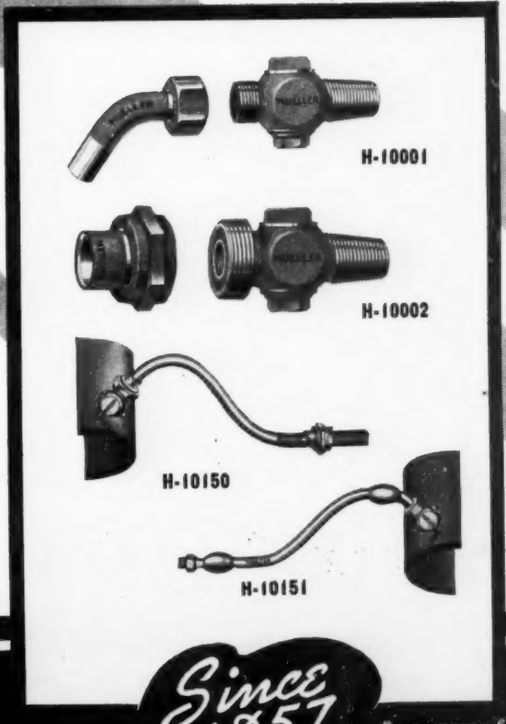
THE MATHIESON ALKALI WORKS (INC.), 60 E. 42ND STREET, NEW YORK, N. Y.

★ MUELLER ★ LEADS THE WAY

For 85 years MUELLER has led in improvements for the water works industry. FIRST to make a corporation stop for inserting in mains under pressure. FIRST to really improve ground key construction. FIRST to design the now standard thread for corporation stops. This thread has a steeper taper and so makes a tighter joint and lessens the tendency to split the main. MUELLER developed a special-formula metal which resists the action of all kinds of soils. MUELLER engineers constantly seek to improve our products or methods of manufacture. MUELLER chemists and technicians constantly maintain laboratory control over every stage of manufacture. The result of these efforts brings to you the finest stops and goosenecks made. Every day more and more water works men turn to MUELLER for the best in water works equipment. Follow the leader! . . . For further details write Dept. W-10.

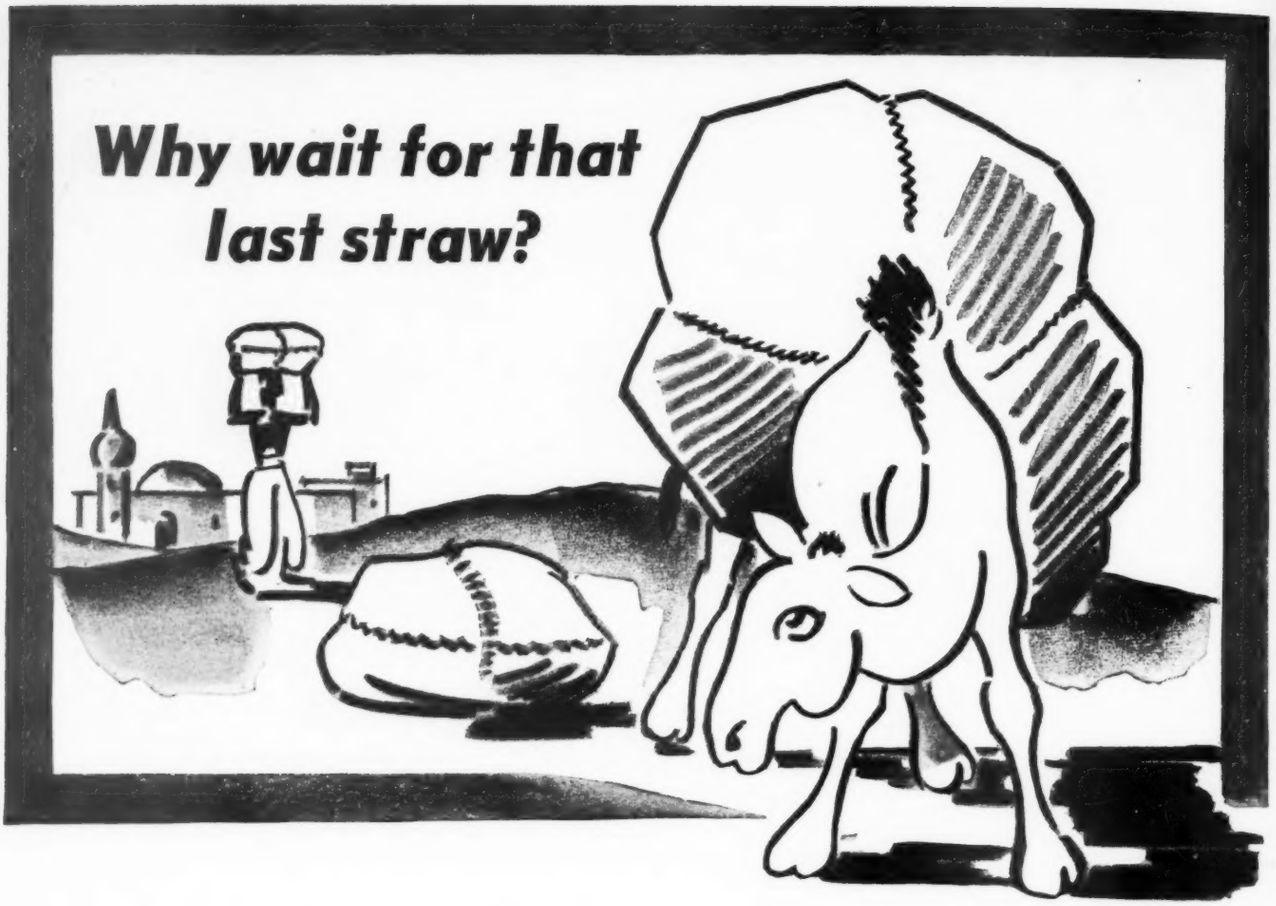
★

It pays to get the best in anything



MUELLER CO. DECATUR ILLINOIS

Since 1857



THINGS are moving fast these days. Municipal facilities that have been adequate for years are suddenly taxed to the limit. New burdens have been added — new demands for service — increased production. And it's none too soon to be anticipating the demands of tomorrow.

This is particularly true of water conditioning equipment, and right now is the time to take stock of the situation — to make a survey of demand and capacity from the standpoint of quality as well as quantity. Maybe there's still a safe margin — but you'll be wise to make certain. And if you're confronted with a problem, play doubly safe and consult Graver at once.

For more than 30 years Graver has specialized in the design and manufacture of water conditioning equipment of all types. Graver engineers have tackled the most difficult water conditioning problems — and solved them. They'll gladly make an analysis of water samples and submit unbiased recommendations without cost or obligation.

Write Graver — today.

WATER SOFTENERS
FILTRATION SYSTEMS
CLARIFIERS
SEWAGE DISPOSAL EQUIPMENT
STEEL STORAGE TANKS
VAPOR CONSERVATION SYSTEMS
WELDED CONSTRUCTION
STRESS RELIEVING
X-RAYING
FABRICATED STEEL AND NON-CORROSIVE PLATE

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Our First Job to do

Copper and brass are not only essential metals for armament and munitions, but they are also extremely scarce.

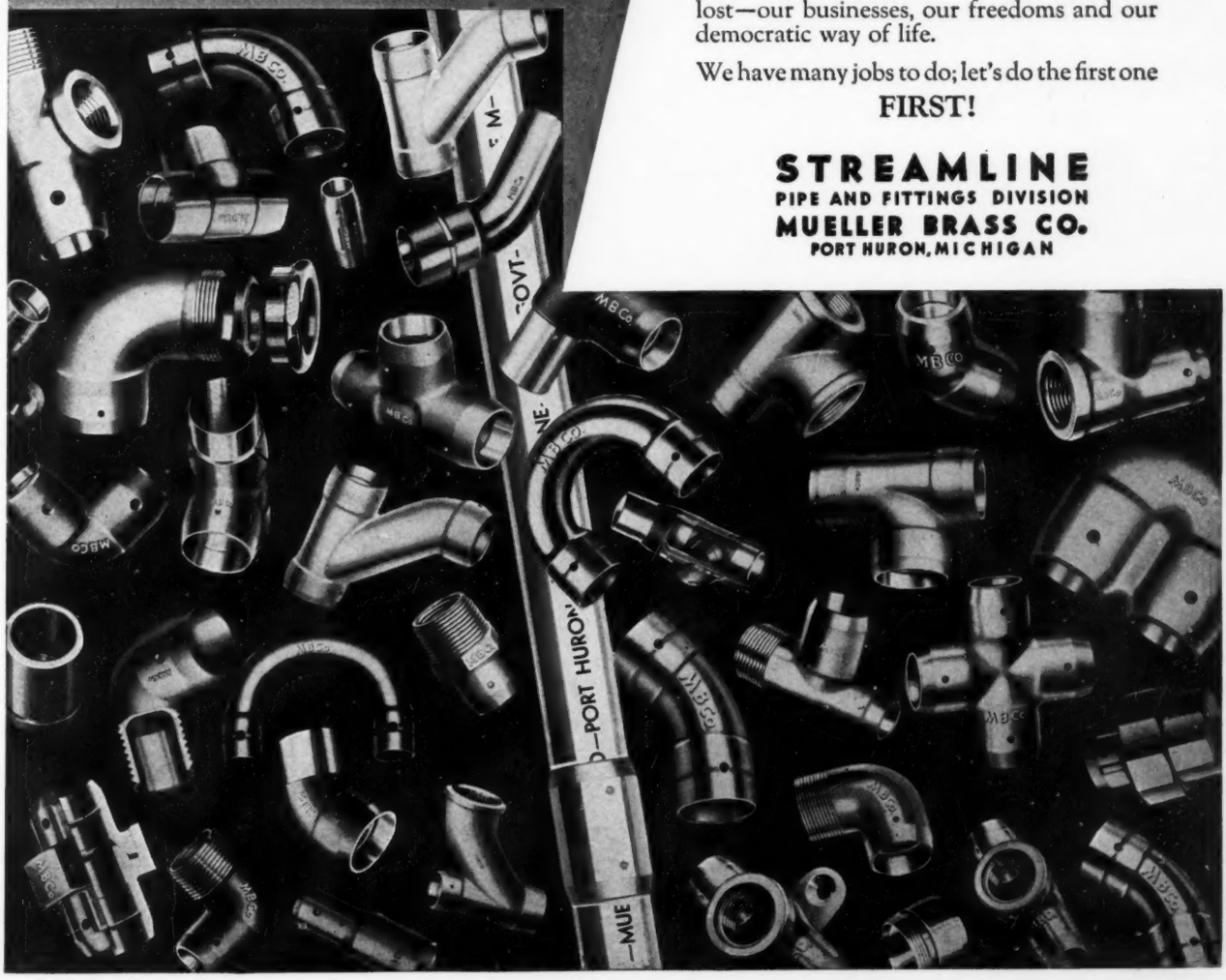
Practically 100% of our production in cooper and brass, which formerly was used in the manufacture of STREAMLINE copper pipe and fittings and other non-ferrous products, is now used for Army and Navy requirements.

We Americans, no matter in what walk of life, realize that armament work must come first. IT MUST TAKE PRECEDENCE OVER EVERYTHING ELSE IF FOR NO OTHER REASON THAN THIS—THAT WE MAY PRESERVE FOR THE FUTURE THOSE VERY BUSINESSES OF WHICH WE ARE NOW TEMPORARILY DEPRIVED. If we fail, everything is lost—our businesses, our freedoms and our democratic way of life.

We have many jobs to do; let's do the first one

FIRST!

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN



Danger being prevented

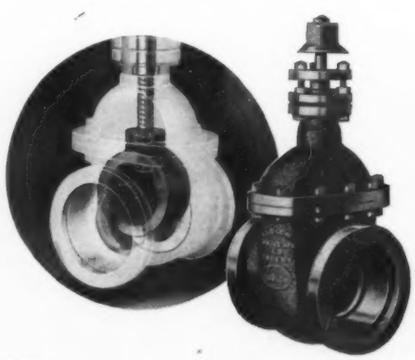
Working day and night, without fanfare, are serious groups of men upon whose shoulders falls the important task of maintaining vital water supplies. These men are doing yeoman service, checking valves and controls. In case of emergency, every valve must work — every valve *shall* work.

Cities equipped with Ludlow Valves throughout their water works systems are assured of proper functioning gates, come what may. Ludlow Valves installed 50 years ago, and out of use for many years, have been found to be in excellent working order!

These rugged valves operate on the famous double-disc, parallel seat principle, developed and perfected by Ludlow. They work smoothly, and close securely — even after years in the open position. Many superior construction features equip them for long, trouble-free service. Write for Catalog.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.



LUDLOW VALVES
SINCE 1866

Conservation Sounds a Patriotic Call

CONSERVATION of meters is a patriotic duty. The Water Works Superintendent has a double conservation responsibility—first to conserve water and second, to conserve equipment. He must take steps to put water meters in "good as new" condition so that they can continue to curb waste and protect revenue.

Those farsighted communities which invested in Badger Water Meters will be faced with less expense in their adjustment and repair programs. . . . Badger's low maintenance cost — as little as 1c per meter per year in many communities — is vital today — not only to present users but to those who are planning to put in meters to conserve water and save revenue.

Plan to attend the American Water Works Association Convention — Chicago June 21-25

BADGER METER MANUFACTURING CO., MILWAUKEE, WIS.

Branch Offices: New York City • Tampa, Fla. • Seattle, Wash. • Savannah, Ga. • Kansas City, Mo. Marshalltown, Iowa • Waco, Texas • Los Angeles, Cal. • Chicago Ill. • Philadelphia, Pa.

2042 A.D.

• The shapes and forms that will carve the skyline in 2042 A.D. can only be guessed at. Their design is on the blueprints of the future. Being manufactured and installed today, however, are smooth-flowing pipe lines that will underlie the cities of tomorrow. Lock Joint Pressure Pipe Lines are constructed and laid with an eye to the demands of distant generations. A century of useful service, immune to tuberculation and corrosion, maintaining their original high carrying capacity and original strength! The life expectancy of Lock Joint Reinforced Concrete Pressure Pipe Lines should make them your best investment in 1942. Whether your project is large or small, your 'phone call, telegram, cable or letter to any of our offices, will bring a prompt reply.

LOCK JOINT PIPE COMPANY

Established 1905

AMPERE, NEW JERSEY

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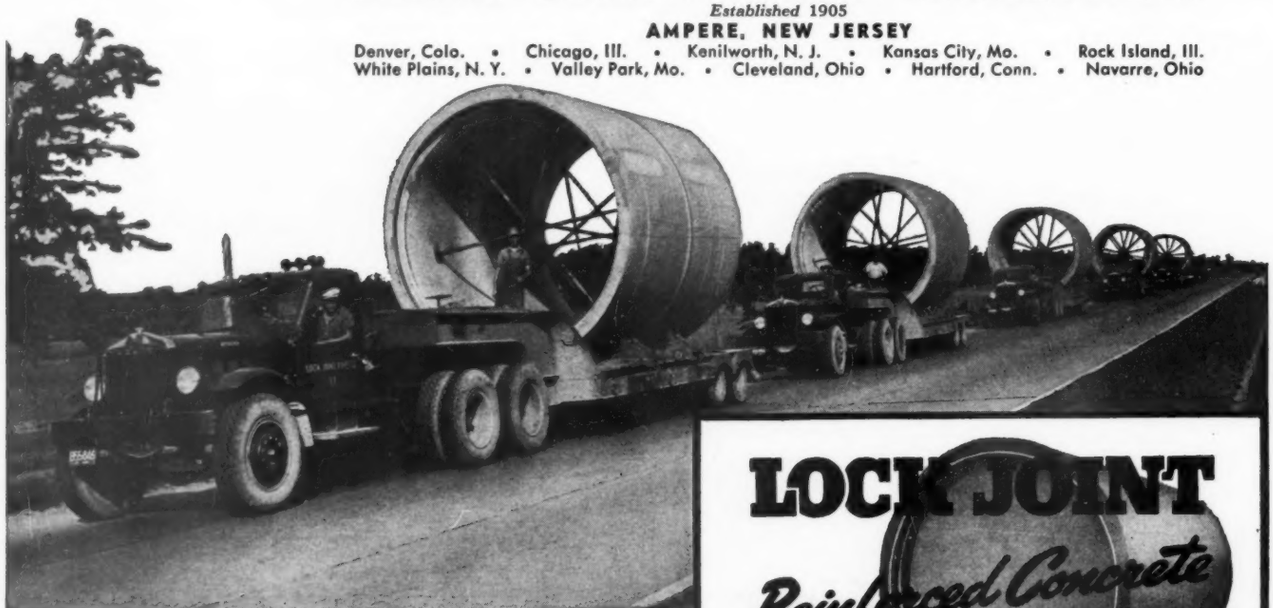

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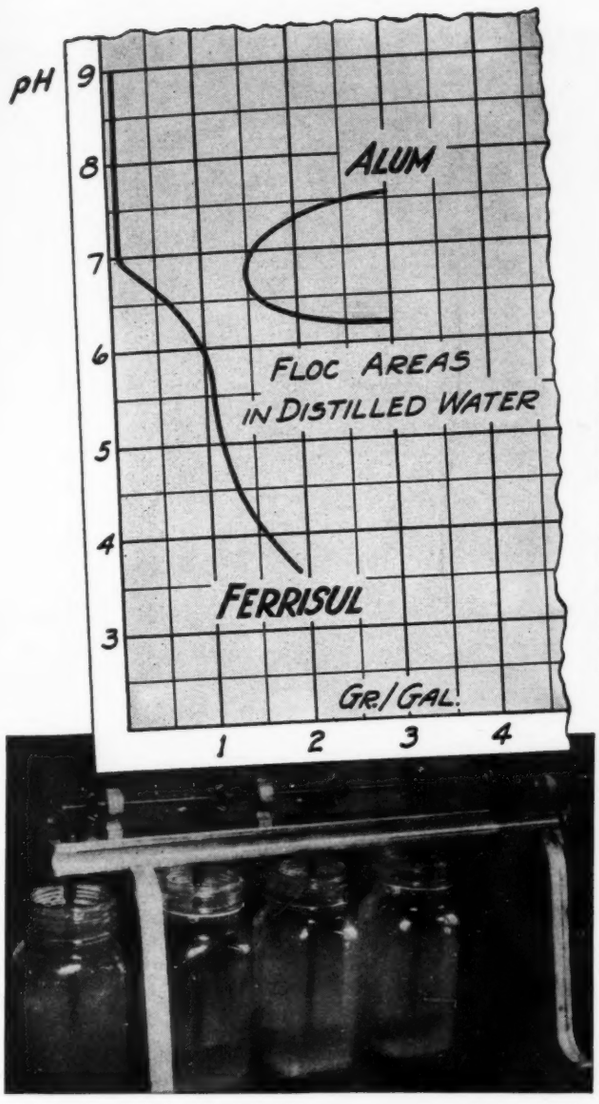

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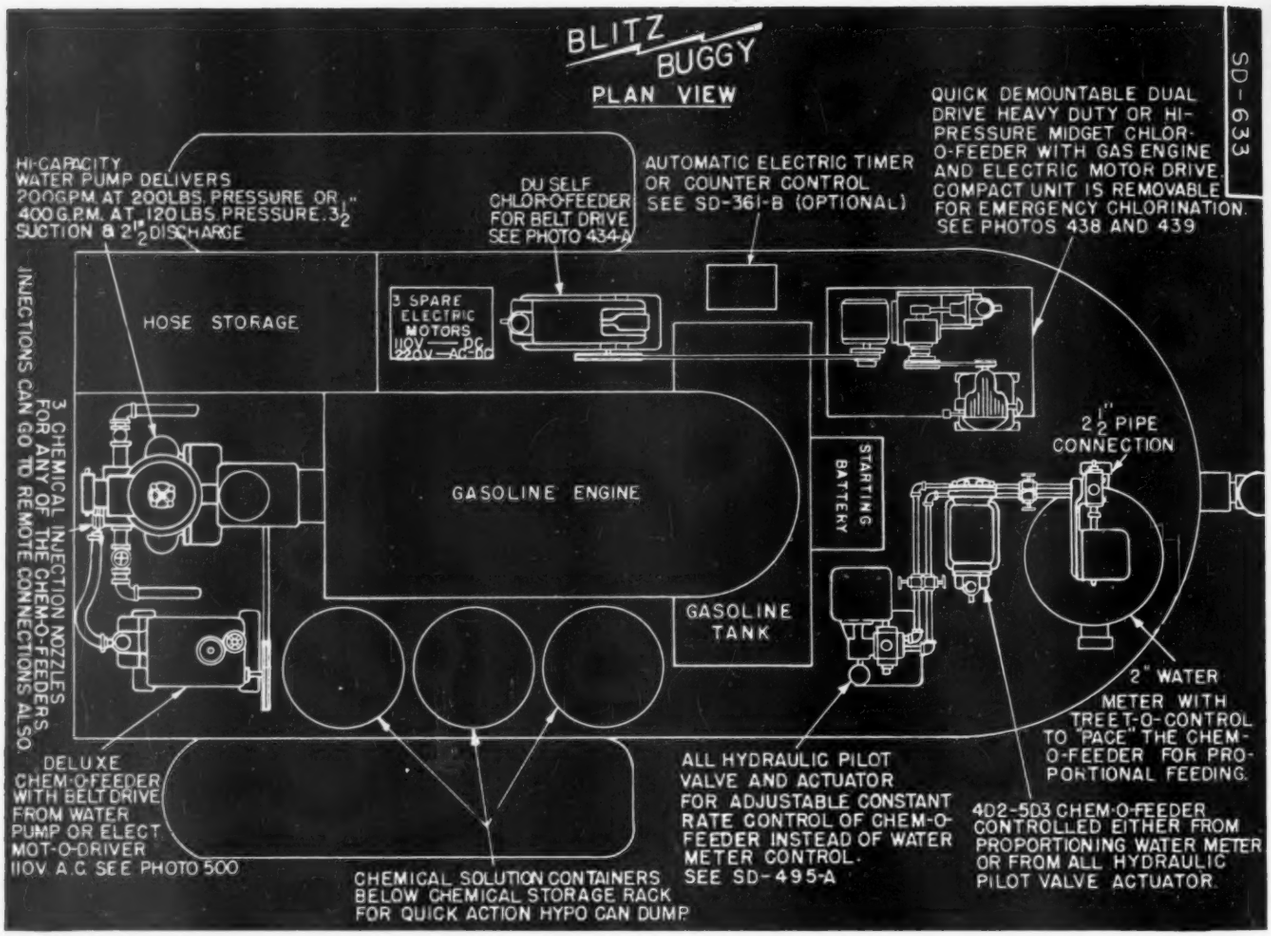
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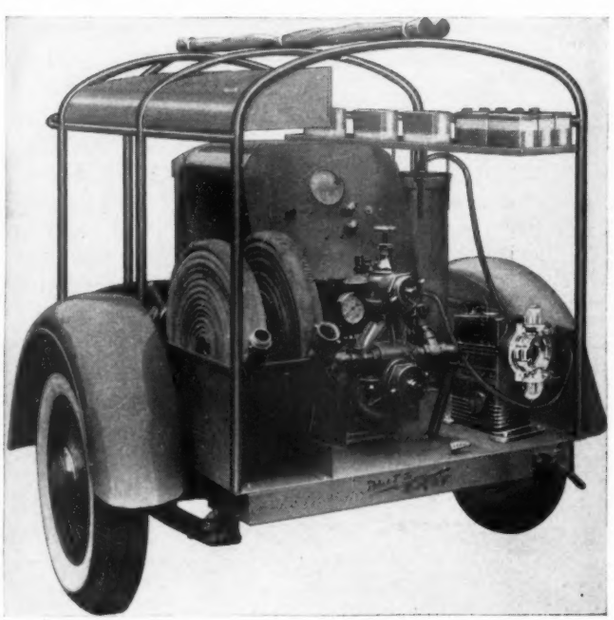
Write at once for complete story contained in our New Emergency Sterilization Bulletin EMM.



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WATER WORKS & SEWERAGE

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E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
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COMING!

"A County-wide Mutual Aid Program"

Is a recital of how many of the subling blocks and details were worked out in developing a practical mutual-aid program for water works in the county-wide plan for Westchester Co., New York, the story being told by the new Commissioner of Public Works for the County—

JAMES C. HARDING,
White Plains, N. Y.

"Operating Experiences at Gary, Ind."

Is a worthy report of operating experiences at the new activated-sludge plant of Gary, Indiana, during a period of more than a year. This plant, producing its own power from digester gas and designed to handle ground garbage, has several novel design features. Even without the aid of garbage solids to amplify the supply of gas for the engines, the ability of the Gary plant to operate efficiently on its own power, solely, but for a short period of the year constitutes one operating experience of marked economic importance; the economical use of air representing another. The authors—

L. R. HOWSON, Designing Engineer,
and
W. W. MATTHEWS, Plant Superintendent.

"Water Softening Improvements for Kansas City"

Relates the results of a study of softening methods and equipment at Kansas City, Mo., which have led to design features to be incorporated in the revamping of the local filtration plant to convert it into a modern softening plant. Softening will permit a plant capacity increase of 50% without need for adding more filters for the purpose—and will reduce the 215 ppm. hard water to a product of 90 ppm. at an estimated saving of $350,000 to Kansas City consumers in soap alone. The improvements to cost $868,803 constitute a part of a ten-year program. The author is—

MELVIN P. HATCHER,
Chief Engr. and Supt., Kansas City, Mo.

"Repairs and Maintenance in Small Water Works"

Is an article chock full of timely ideas and suggestions for the small water utility operator. We might add that it will also bear study by those connected with operation and maintenance of the larger plants. This is one of those rare and highly useful articles for operators and particularly is this so at the present time. The author—

GUY A. RHOADS, Manager,
Public Utilities of Safford, Arizona.

"The Role of Bacteria in Corrosion"

Is revealed in a report of studies and experimentation which most definitely points to the fact that living organisms play an important part in corrosion of iron and steel. Evidence secured further conclusively reveals that corrosion and tuberculation of water mains, and red-water or black-water in dead ends and sluggish flow sections in particular, can be brought under control by checking bacterial growths in the film next to the walls of the pipes. The corrective tried successfully was that of maintaining residual chlorine in the water entering the corroding sections, this being more readily accomplished through ammonia-chlorine treatment. The work represents the most conclusive evidence yet produced that dead-end troubles are markedly intensified by, if not due almost in whole to, bacterial activity in the wall film on the pipe interiors and in bottom deposits. The author is—

A. H. THOMAS, Chief Chemist,
Armco Research Laboratory, Middletown, Ohio.

"Service Shooting"

Reveals the Elgin Method of clearing consumer service lines by use of an effective method of "shooting" the encrusted line with a charge of compressed air which scours the pipe interior without damage to the walls. The author—

LA VERNE TRENTLAGE,
Foreman, Meter Div.,
Water Dept., Elgin City, Ill.

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Survey Shows Possibilities Of Increased Revenue

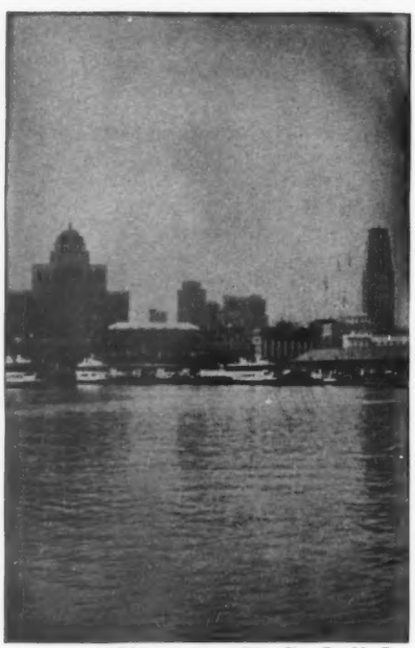

Photo courtesy Canadian Pacific Ry.

Neglect of Meters Blamed for Losses

Proper Meter Maintenance Program Strongly Urged

From paper presented at Toronto Convention, A. W. W. A.

TORONTO—A survey of the meter maintenance practices of a group of municipalities, including Canadian cities of over 30,000 population and U.S. cities of between 100,000 and 200,000 population, proves that today water utilities cannot afford to install meters and then neglect them, forgetting that they are really "precision instruments" and that proper repair and testing will repay many times the time and money spent.

A meter maintenance program, such as outlined here, will reduce the cost of waterworks operation; lengthen meter life; and result in a distinct improvement in revenue . . . not by increasing the cost of water to the consumer, but by revealing unsuspected leaks and waste, thereby also conserving water and reducing useless pumping.

Recommendations

1. Test all meters when purchased.
2. Remove them after a certain period of time or after a certain total consumption, or combination of both.
3. Test them when brought into the shop for repairs, keeping a record of these tests.
4. Repair them carefully, especially the chambers and gear trains, keeping a record of repair costs, both parts and labor.
5. Test them after repairs, requiring a high percentage of registration on a 0.25-g.p.m. flow.

Such a procedure will without a doubt result in distinct increases in water department revenues.

Even though your city or town may have some difficulty in getting new water meters today, you still can greatly increase the accuracy and lengthen the life of your present meters by promptly putting into effect a proper program of testing and repair. Money saved the consumer through proper meter maintenance can be invested in

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23

WATER WORKS & SEWERAGE

VOL. 89, NO. 4 *A Gillette Publication* APRIL, 1942

THE COMBINED COMPLETE TREATMENT OF MEDIUM AND HIGH CONCENTRATION WASTES

By Parallel, Interacting Dissimilar Processes

EDWARD B. MALLORY
Director
LANCASTER RESEARCH LABORATORIES*
HACKENSACK, NEW JERSEY

A Description of the Design and Operation

of a Waste Treatment Plant Embodying the Author's "Regenerative Digestion Process" for the Treatment of High Concentration Wastes and By-Product Oxidized Sludges; and the Complete Secondary Treatment of Medium Concentration Wastes and Regenerative Digestion Tank Effluents by the "Oxidized Sludge Process"—the Latter Being a Modification of the Activated Sludge Process Through a Uniquely Controlled Scheme to Attain Assured and Even Performance on a Predictable Basis.

IT IS perhaps pertinent to introduce this report with a few axiomatic observations.

Predicated on the statement, that sewage and liquid industrial wastes consist of pure water containing impurities, it is the logical purpose of a treatment works to dissociate the impurities and the pure water, to deliver the pure water to the receiving waters of the region and to prepare the segregated impurities for disposal without nuisance or menace to the health of persons or animals.

Impurities occur in two principal forms, dissolved and suspended. Dissolved impurities may be segregated to some extent by conversion to gas, or they may be converted to stable compounds. The suspended impurities when segregated in the form of sludges, still contain a substantial pure water component and exhibit a relatively high concentration of impurities.

These sludges are amenable to the further segregation of the suspended impurities and the water vehicle and the further reduction of the unstable dissolved and suspended matter, with the resultant production of a relatively stable suspended solids residue and a substantially purified water. Many raw industrial wastes similarly exhibit high concentrations of unstable matter. It seems logical to combine such sludges and high concentration wastes and to effect the desired segregation of the water vehicle and suspended matter, and the reduction of the unstable dissolved and suspended components, in a treatment cycle particularly adapted to this type of waste.

For purposes of convenient differentiation, sewage and industrial wastes, having impurity concentrations represented by a B.O.D. value of less than 500 ppm., will be referred to as having "low" concentrations. Those producing 500 ppm. to 3,000 ppm., B.O.D., will be referred to as "medium" concentrations. And those exhibiting B.O.D. values from 3,000 ppm. up to 50,000 or more, will be referred to as "high" concentrations.

In the industrial field, wastes occurring in each classification are frequently encountered in a single manufacturing plant. It is often possible and practicable to segregate the low and medium concentration wastes from the high concentration wastes at the point of origin, and to devise individual treatment methods best adapted to treat such segregated wastes. This is particularly true in some branches of the dairy industry in which losses resulting from raw milk spillage, utensil washing, washroom and toilet wastes and other normal wastes arising in the manufacturing plant, may be collected by a suitable system of floor drains, resulting in medium concentration wastes—500 to 3,000 ppm. B.O.D. High concentra-

*A Division of Lancaster Iron Works, Inc., Lancaster, Pa.

Note—This paper, written for publication in "Water Works and Sewerage," was read before the Sanitary Division of the Am. Soc. of Mechanical Engineers, New York City, January 20, 1942.

tion wastes, such as cheese whey and curd wash waters, may be collected readily at the point of origin through a separate system of drains, thus representing a complete segregation of the medium and high concentration wastes. It is also frequently possible to segregate substantial volumes of clean water wastes, such as condenser cooling water, and to reuse such waters or to discharge them directly to the receiving stream, thereby reducing the volume of the wastes requiring treatment.

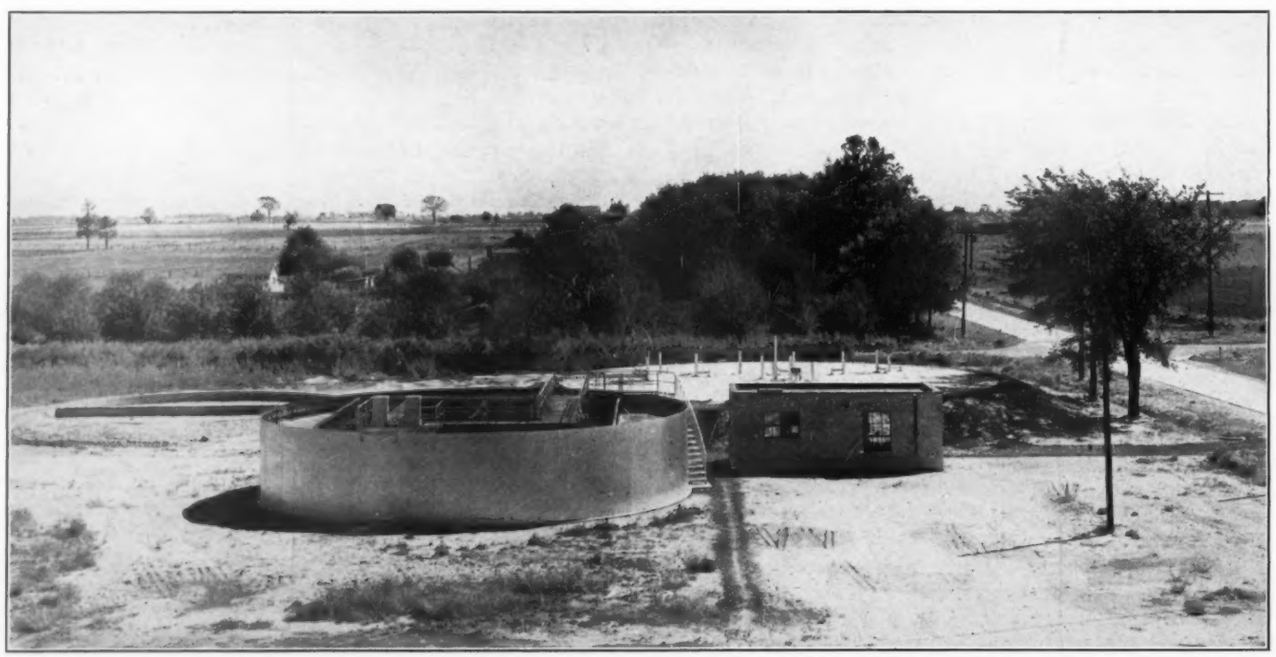
Milk wastes are highly colloidal and heretofore have presented a difficult problem in effecting a high degree of treatment and the delivery of a substantially pure effluent to the receiving stream. Whey and curd wash waters have represented an even greater problem in view of the extremely high B.O.D., volatile solids and acid concentrations encountered. This has encouraged the practice of evaporating whey to higher solids concentrations and the disposal by readmixing this concentrated whey with cheese curd in the manufacture of certain forms of processed cheese, or as hog feed or other methods of disposal. Evaporation is generally a very expensive method of effecting disposal of this high concentration waste. It frequently requires the use of production equipment and introduces the attendant difficulties encountered in cleaning the vacuum pans and the resulting increase of floor drain waste loadings.

It is believed that the character of the treatment processes devised to accommodate wastes of this character, and the degree of treatment which may be accomplished reliably and consistently, can best be conveyed by describing methods and equipments now in this service and the resultant performance.

The Mead Johnson Treatment Works

The industrial waste treatment plant erected and put into service at the manufacturing plant of Mead Johnson & Company, Zeeland, Michigan, during the Summer of 1941, is believed to be the largest milk waste treatment plan in the world. It is also believed that it exhibits consistently the highest degree of clarification and purification yet accomplished in the treatment of milk wastes at any point. Mead Johnson & Company manufacture infant foods, and other pharmaceutical products in powdered form derived from raw milk. In the manufacturing plant and processes, substantial volumes of "low," "medium" and "high" concentration wastes are produced. In addition, substantial quantities of powdered wastes arising from spray drier losses and losses in the packing room are collected in the waste drains. An initial survey indicated that both the volume and the load concentration of the wastes arising in this manufacturing plant, varied through an extremely wide diurnal and seasonal range. General liquid waste flow rates may vary from 12,000 or 15,000 gallons per day up to 150,000 to 175,000 gallons per day. Whey and curd wash water wastes may vary from 14,000 to 16,000 gallons per day during periods of maximum production down to quantities of 6,000 to 10,000 gallons per day during periods of light production. Then, for a period of several months in the year, no whey and curd wash waters are produced.

It was further indicated that the combined low and medium concentration general wastes collected by the floor drains would exhibit B.O.D. concentrations varying from 800 ppm. up to 2,500 ppm., and that whey and curd wash water wastes would exhibit B.O.D. concentrations varying from 1,500 to 2,000 ppm. in the case of third wash waters, up to 50,000 or 60,000 ppm. in the case of whey proper. A study of the survey data indicated total general waste loadings varying from 200 pounds of B.O.D. per day up to approximately 1,500 pounds per day, with whey and curd wash water loadings varying from 800 or 900 pounds per day up to approximately 2,000 pounds per day. It was evident that a treatment works capable of accommodating a total loading of approximately 3,000 pounds of B.O.D. per day at flow rates averaging 60,000 to 100,000 gallons per day, with maximum peaks of 150,000 to 200,000 gallons per day, would be required to provide adequate treatment to these wastes. This would represent a population equivalent of approximately 18,000.



General View of Milk Waste Treatment Works—Mead Johnson & Co., Zeeland, Mich.

The Michigan State Health Department requirement relating to treatment plant discharges delivered to the local receiving waters, stipulated an effluent with a maximum B.O.D. or suspended solids concentration not exceeding 25 ppm. At a maximum loading of 3,000 pounds of B.O.D. per day, this restriction indicated a required treatment plant B.O.D. removal efficiency in excess of 99 per cent.

The System of Treatment

Reverting to the initial axiomatic observations, it may be remarked that the design of the treatment works erected to serve this requirement, reflects the logic recited. The general liquid wastes, powdered wastes and employees' wash room and toilet wastes, are collected through the existing drain system as before. The whey and curd wash water wastes are intercepted at the point of origin and delivered through a separate conduit to the treatment works. The treatment works comprise units and equipment to provide two interacting, dissimilar processes. As indicated in Fig. (1), the general wastes and selected curd wash waters are delivered directly to an aerator-clarifier unit employing the "Oxidized Sludge Process" of treatment. The whey and selected curd wash water wastes are delivered directly to a regenerative digester. This heated air-blown digester makes use of what might be truly termed an "Activated Sludge Process." The excess oxidized sludge developed in the aerator-clarifier unit is also delivered to the regenerative digester for further treatment and the effluent from the regenerative digester is in turn delivered to the aerator-clarifier unit for complete treatment. No polluted liquid wastes arising in the manufacturing plant can reach the receiving stream unless and until subjected to complete treatment in the aerator-clarifier unit.

The Secondary Process and Equipment

The aerator-clarifier unit, providing the secondary treatment, is a circular steel tank 52 feet in diameter with a water depth of 11 feet, concentrically arranged about a square clarifier system, consisting of two clarifiers each 17 feet by 34 feet in plan, with a mean water depth of 9 feet 4 inches. (See Fig. 1.) The need for minimizing erection costs precluded the duplication of treatment units. The receiving water requirements dictated the need for treatment units which could be maintained in service continuously, with the provision that any component part or appurtenance could be removed for inspection, repair or cleaning without disturbing the continuity or efficiency of the process.

For example, it has been found that porous plate or tube diffusers cannot be employed successfully in an aeration tank designed to accommodate the particular type of sludge or mixed liquor required in a treatment cycle of this character. Hardened encrustations, difficult to remove with a chisel, are promptly encountered. This is similarly true in many indus-

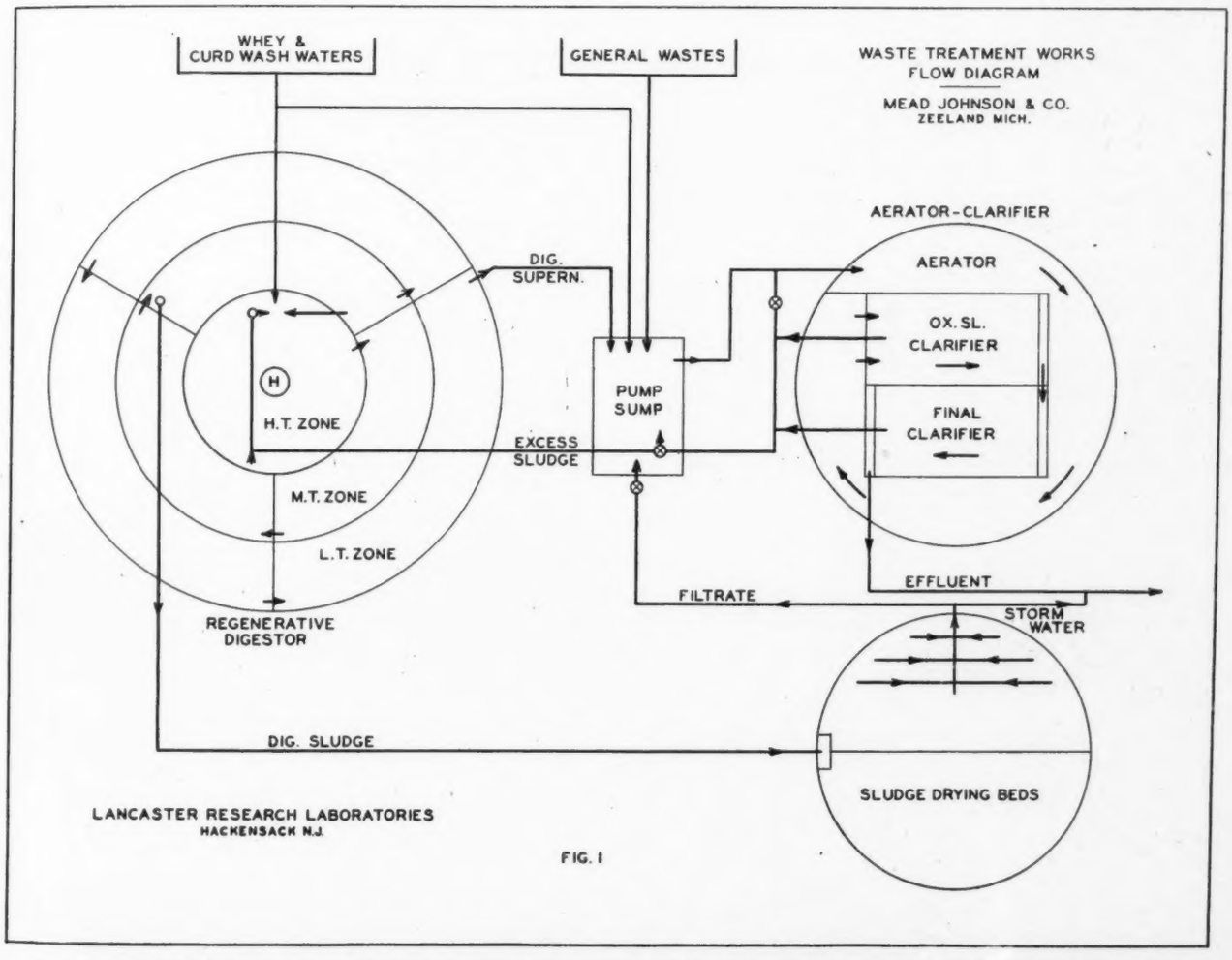


Fig. 1.—Flow Diagram of the "Oxidized Sludge" and "Regenerative Digestion" System of Waste Treatment.

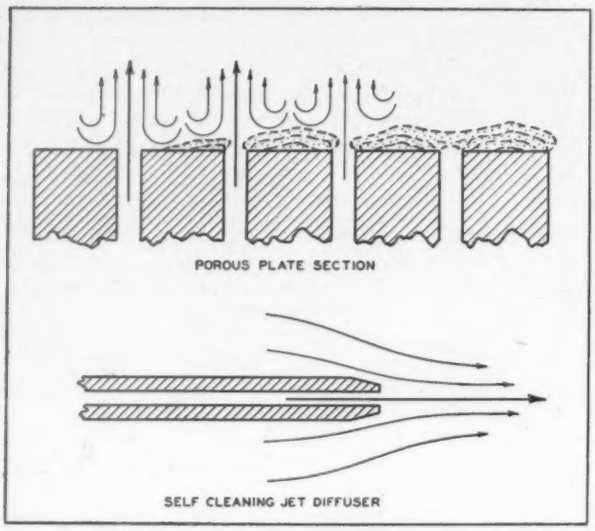


Fig. 2.—Porous Plate and Self-Cleansing Jet Diffuser.

trial processing cycles, for example, in the manufacture of yeast. The tendency of microscopic suspended solids to adhere to the rough surface of the porous diffuser causes fouling and in time a complete stoppage of the pores. In the manufacture of yeast and similar products, it was found that micro-organisms would adhere to the surface and penetrate the interstices of the diffusers causing organic contamination and consequent ruin of the product.

Figure 2 is a diagrammatic representation of a magnified section of a porous diffuser in which the progress of solids encrustation on the surface of the diffuser is represented. The jet of air passing through the individual pore of the diffuser is projected perpendicularly from the surface of the diffuser at a relatively high velocity for a short distance. In the manner known to all, this jet of air draws with it a volume of liquid from the area contiguous the pore. This liquid must be replaced by other volumes of liquid from areas above the plate. As illustrated by the arrows in this sketch, these replacing volumes of liquid impinge on the surface of the plate between the pores. When liquids contain viscous matter or various components such as iron, calcium, casein, etc., these components adhere to the diffuser surface and by the process of aggregation or oxidation slowly but certainly build up a hard encrustation which gradually encroaches upon the orifice spaces and in a short time closes them one after another finally resulting in a chokage or stoppage of the pores of serious proportions. This, of course, is reflected in greater friction through the remaining pores and a consequent increase in the air pressure and power demand. To a lesser degree, these difficulties are experienced in aerators employed in the treatment of wastes of lower concentrations such as municipal sewages. The literature of the art is replete with reports of such difficulties and the employment of chlorine application to the air lines or various acid, grinding, or high temperature methods of cleaning porous diffusers.

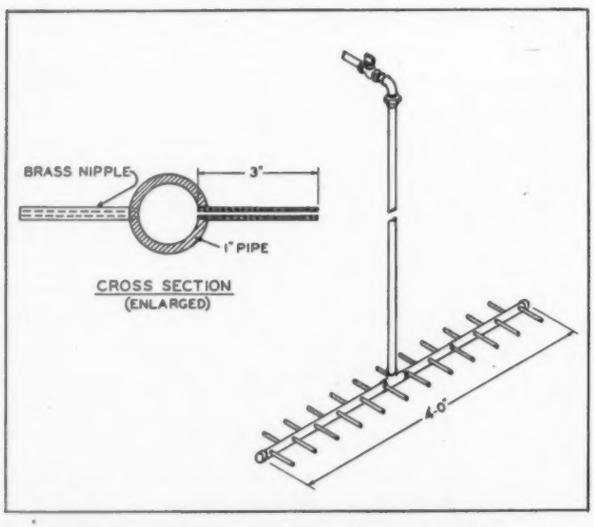


Fig. 3.—Typical Self-Cleansing Jet Diffusers.

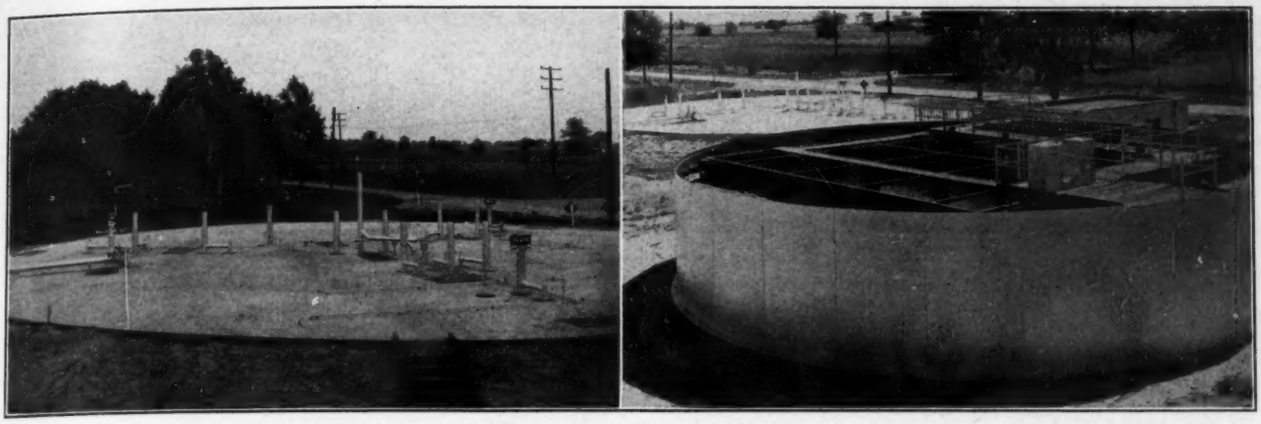
The Vortex-Ring Aerator

It is perhaps proper to attribute a large part of the increased efficiency of the vortex ring aerator employed in the oxidized sludge process, or modifications of this design, to the higher initial and continued effectiveness of the jet diffusers. The belief in the desirability of minute bubbles has long been discarded in favor of coarser grained diffuser plates and tubes. And, in industrial production cycles this theory has, in recent years, been definitely exploded by the demonstrations of the greatly increased efficiencies of the jet diffuser. In municipal practice, involving porous diffusers, mixed liquor concentrations in excess of 3,000 or 4,000 ppm. can seldom be maintained. In the aerator at Zeeland, mixed liquor concentrations in excess of 9,000 ppm. have been employed for extended periods to accommodate specific loadings. In municipal practice, a maximum of .20 pounds of suspended solids per cubic foot of aerator holding capacity is seldom if ever exceeded. The general average is from .05 to .15 pounds per cubic foot. In the Zeeland aerator, average suspended solids inclusions in the aerator of .35 pounds per cubic foot holding capacity has been the practice, with maximum suspended solids concentrations of .55 pounds per cubic foot reached at times.

The jet diffuser design circumvents the difficulties experienced in the operation of flat porous plates or tubes. The air jet passing at high velocity from the orifice in the nipple draws with it substantial volumes of water from regions behind the orifice. (Fig. 2.) It has been found in practice, that a substantial area of the jet tube is polished by the rapid passage of water along the exterior of the tube, which serves to keep the end of the diffuser consistently cleaned.

Self-cleaning diffusers of this type (Fig. 3) are provided in groups of 75 and located approximately 10 feet 9 inches below the surface of the liquid in the aerator. Each group of diffusers is provided with an individual air supply pipe connected through a union to the source of air supply above the water line, and readily removable by the operator for inspection and cleaning without disturbing other groups or the continuity or efficiency of the process.

The air supply manifold serving these diffusers and other air requirements in the aerator-clarifier unit, also serves the dual purpose of providing structural rigidity to the tank. A typical structural form of channel section is bent to conform to the radius of the tank and welded to the inner wall of the tank near the top. This serves as a combined air manifold and as a substitute for an angle or other structural form required for purposes of mechanical strength.



Close-ups of the Regenerative Digester (left) and the Combination Aerator-Clarifier.
(At what is believed to be the world's largest milk-wastes treatment plant.)

The Clarifiers

The need for continuity of operation, the avoidance of disturbance of the sludge settling in the bottom of the clarifier, and elements of process design, precluded the use of sludge scraping devices or any other moving mechanical equipment or appurtenance which could not be removed readily for inspection or repair without unwatering the tank or otherwise disturbing the continuity or efficiency of the process. It is pertinent to note that only two mechanical equipments involving moving parts, bearings, or other parts subject to wear and repair, are employed in the entire plant, namely, the main waste pumps and the compressors.

Each clarifier is provided with 8 inverted pyramidal hoppers. The sludge is collected in and removed from the bottom of each hopper by an individual air lift discharging into a collection manifold, which in turn discharges the return sludge into the aerator at a point closely contiguous to the point of delivery of the raw wastes. Excess sludge is diverted from the discharge pipe of one of these air lifts as required, and is delivered to the regenerative digester by gravity. The effluent from the first or oxidized sludge clarifier passes over a short overflow weir at the discharge end of this clarifier into an open trough launder, which delivers this effluent into a flash (chemical) mixing tank at the influent end of the second or final clarifier. Under normal conditions of operation, no chemicals are mixed with the first clarifier effluent before discharge into the final clarifier. During periods of persistent overload or as emergency factor of safety to compensate for faulty operation, coagulating chemicals may be admixed with the first clarifier effluent in the flash mixer before discharge into the final clarifier. Substantially complete sterilization may be obtained if desired by the further admixture of a small quantity of calcium hypochlorite.

The effluent from the final clarifier similarly passes over a short weir into an open trough launder, which discharges into a vertical hydraulic cascade and thence into an outfall conduit which discharges into a dry receiving ditch about 100 feet from the treatment works.

The aerator is designed for a volumetric holding capacity of approximately 10 cubic feet per pound of B.O.D. per day at full load. The air requirements of the diffusers and the various air lifts in the secondary process are normally supplied by one 600 cfm. Roots-Connersville heavy duty compressor, operating at a gauge pressure of 5.1 pounds per square inch, and drawing about 21 horsepower. This indicates a full load total plant air demand, including the requirements of all diffusers and air lifts, of approximately 290 cubic feet per pound of B.O.D. removal per day. This is only about one-third of the diffuser requirements of the more efficient municipal treatment works of the so-called "Activated Sludge" type which are restricted to the treatment of low concentration wastes. It is also of note that the volumetric holding capacity of the aerator is approximately one-third of the aerator holding capacity per pound of B.O.D. removal capacity exhibited in conventional municipal plants. This greatly increased efficiency is apparently accomplished to a measure at least by employing the combination of a vortex ring aerator, which appears to be the most efficient aerator yet devised, and jet diffusers which provide a consistently high aeration efficiency.

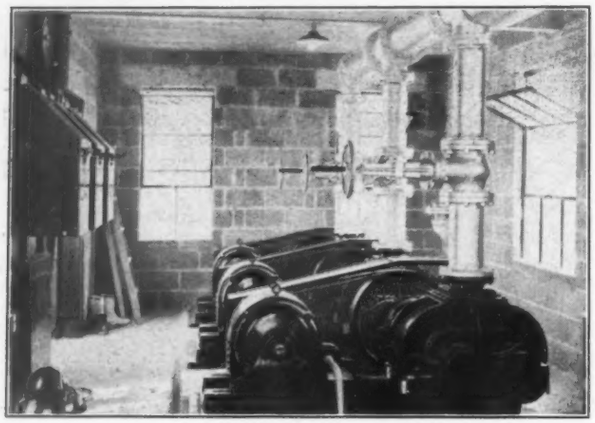
Top Water Aeration in Clarifiers—Is Unique

It may be startling to a visitor, experienced in conventional "Activated Sludge" plant practice, to observe that the supernatant (top) liquid in the clarifiers is aerated by groups of submerged diffusers across the end of the clarifier. This serves to increase the precipitation of suspended solids, maintain a desirable dissolved oxygen concentration in the liquid contents of the clarifier during night hours or other periods of low flow rates, and also to agitate the surface continuously to cause any scum or other matter floating on the surface to drift to the opposite end of the clarifier where a row of air jets above and tangentially impinging on the surface, forces it up an inclined surface into the scum gutter for delivery by gravity to the regenerative digester.

Secondary Process Control

It is perhaps desirable to discuss the principles and control of the secondary process before proceeding with a description of the Regenerative Digester.

An Oxidized Sludge Process cycle has a sharply defined maximum constant load capacity. This is determined by the plant structural and equipment design. The process mechanism, however, is readily adjustable, with practicable promptness, to accommodate a wide range of loadings within this capacity. The process mechanism may also be adjusted to accommodate substantial overloads of relatively short duration. The permissible degree of such overloads will be somewhat in inverse ratio to the period of overloading.



The Pump and Blower Room
(Control Switches and Instrument Board on Left.)

The control of the "Oxidized Sludge Process" is, in fact, an extremely simple procedure. A number of principles have been laid down which may be translated readily into operating technique. While some of the values in the following ratios may depart somewhat from the theoretical values employed in design considerations, the simplified expressions (as shown) agree within practical limits and, accordingly, have been employed as plant operation guides.

It is a popular conception that sludge in mixed liquor settles at a rate in inverse ratio to its suspended solids concentration. Given two specimens of the same mixed liquor, having a sludge component developed in a process under uniform conditions of load and flow, and aeration of uniform period and intensity, one of the specimens having been diluted with clear effluent to reduce the suspended solids concentration; this concept is true.

A long period of observation has developed the belief that the failure of so many treatment plants of the so-called Activated Sludge type to deliver a highly clarified and purified effluent reliably and consistently, may generally be attributed to two major causes. 1st—Flow rates and/or loadings in excess of the capacity of the plant, frequently resulting from inadequate or unbalanced plant design, and 2nd—Instructions to the operators predicated on misconceptions and an incomplete knowledge of the process mechanism. The remedy in the first instance, is of course, additional equipment reflecting balanced design. Remedy in the second case may be accomplished by developing the operator's understanding of the process mechanism and his ability to employ proper control measures. In developing this understanding it is advantageous to recognize the general principles that—

1. The settling rate of "Oxidized Sludge" in mixed liquor is a function of the degree of oxidation of the sludge.
2. The capacity of the "Oxidized Sludge Process" to accommodate loadings is a function of the amount and degree of oxidation of the sludge.

Connotation of these general principles suggests additional expressions of more specific character which may be formulated and, in turn, evaluated in terms of the characteristics of any particular treatment cycle.

Parenthetically, it may be stated that it is frequently necessary to compensate for the effect of extraneous factors which may influence test results when exploring many physical and chemical mechanisms. For example, when testing the settling rate of oxidized sludge, when a specimen of mixed liquor poured into a settling glass a condition of absolute quiescence is difficult to attain until after a period of several minutes. Definite physical and chemical changes are initiated the moment the mixed liquor is removed from the influence of the aerator; for example, synartesis is one. These reactions are obviously masked until absolute quiescence is established.

Both mechanical and chemical factors again become influential as the test progresses, such as compacting or gasification. These again influence the rate of settling. In common with studies of other physical phenomena, it is found that a region exists relatively free from extraneous influence where reactions occur at normal rates representative of the characteristics of the matter subjected to test. In the selling test of oxidized sludge, this period occurs from about 5 minutes after the specimen is poured into the settling cylinder to about 60 or 70 minutes after settling has commenced. It has also been found that under optimum conditions certain physical characteristics exhibit a straight line rate of progress from the theoretical zero during this period. This establishes an uniform reference basis which coincides with and reflects optimum conditions and may accordingly be adopted as a basis of optimum determination.

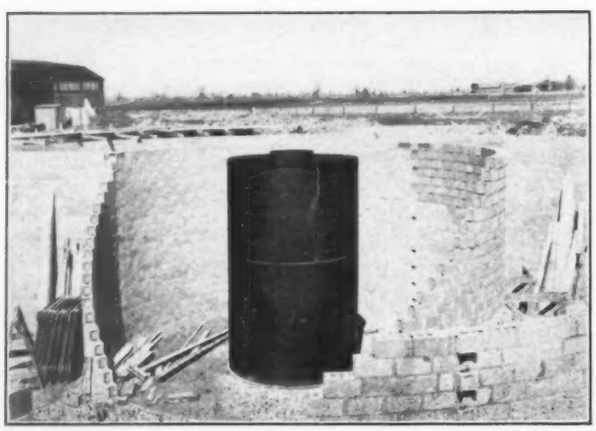
Predicated on the foregoing, the following more specific principles may be enunciated and evaluated.

3. Oxidized Sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, will settle in one hour, in a standard two liter "Settlometer" to a volume determined by the ratio—

$$S = \frac{1000}{K}$$

Wherein S = Sludge volume in CC/liter
K = A treatment cycle constant,

$$\frac{2A}{C} - 1,$$ in which, A = effective aeration period in hours and,
C = effective sedimentation period in hours.



Regenerative Digester Under Construction.
(Shows the heater at the tank center and the annular concentric medium and low temperature chambers.)

4. Oxidized Sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, after settling for one hour in a standard two liter "Settlometer," will exhibit a concentration determined by the ratio—

$$R = MK$$

Wherein M = Mixed liquor suspended solids concentration in per cent, by standard centrifuge tests

R = Settled sludge suspended solids concentration in per cent, by centrifuge tests

5. Oxidized Sludge of optimum characteristics in mixed liquor taken from any given treatment cycle, when settled in a standard two liter "Settlometer," will exhibit a straight line concentration rate during a one hour settling period.

This may be formulated, $R = \frac{T}{E}(MK - M) + M$

Wherein T = Observed time in minutes
E = A constant — 60.

6. Oxidized Sludge of optimum characteristics, in mixed liquor of any concentration, taken from any given treatment cycle, when settled in a standard two liter "Settlometer," will exhibit a settling rate during a one hour settling period,

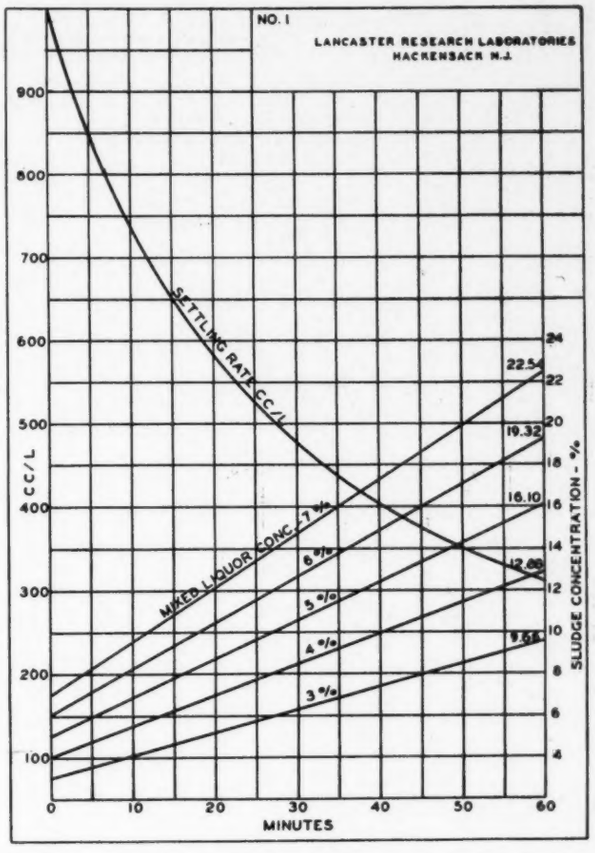
according to the formula $S = \frac{1000\,M}{\frac{T}{E}(MK - M) + M.}$

Or in terms of plant characteristics—

$$S = \frac{1000\,EC}{2\,AT - 2\,CT + EC}$$

Employing the foregoing ratios it is a relatively simple matter to plot optimum settling and concentration curves for the mixed liquor from any given tank system. As an example, Graph 1 illustrates an optimum settling curve for the Mead Johnson treatment works, as computed by Equatation No. 6. This graph also illustrates the optimum concentration rate of sludge when settled from mixed liquor of varying mixed liquor concentrations, as computed by Equation No. 5. Underoxidation will exhibit concavity in the concentration curve, below the optimum straight line and a lower terminal value. Over-oxidation will exhibit convexity above the straight line and a higher terminal point.

Application of these principles in practice is predicated on the logic that, as the tank system cannot be altered readily to accommodate the fluctuating flow and load conditions, thereby to maintain the process in equilibrium, the remaining factor susceptible to alteration or "control" at the will of the operator, is the sludge. Thus, with a ready means of determining the amount and degree of oxidation of the sludge, a ready means to alter this volume and degree of oxidation, a knowledge of the optimum degree of oxidation of the sludge, a knowledge that the settling rate of the sludge is governed by the degree of oxidation (and the corollary, that the degree of concentration under specified circumstances is a measure of the degree of oxidation) it is practicable to regard the principal mechanism in this process as "Oxidized Sludge" and to express its condition as a ratio of the



Graph 1.—Optimum Sludge Settling and Concentration Curves for Mead Johnson Plant.

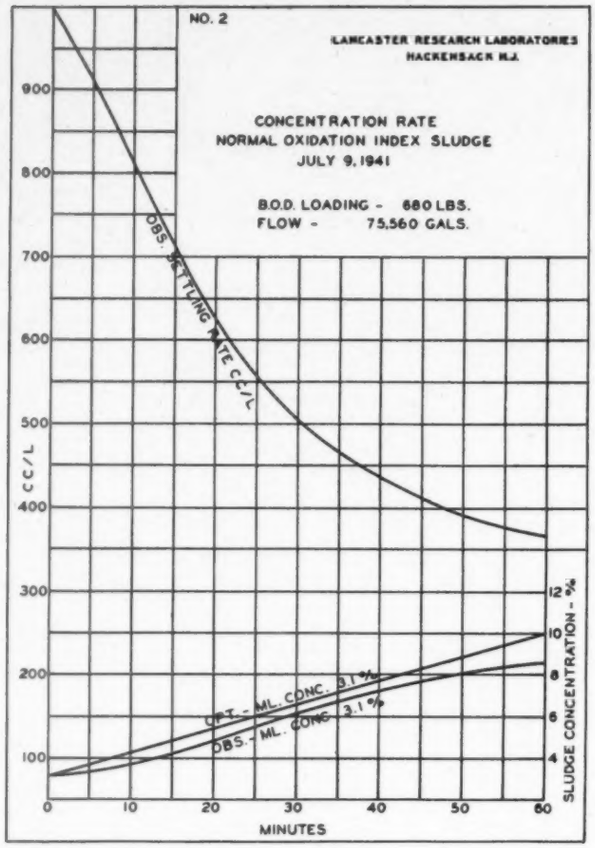
observed degree of oxidation to the optimum degree of oxidation. This may be expressed—

7. "Oxidation Index" in $\% = \frac{100{,}000}{SK}$

Application of the Principle

At the Mead Johnson treatment works the loadings may very within a wide range. Daily secondary process B.O.D. loadings as low as 120 pounds and in excess of 1,400 pounds, at flow rates varying from 12,000 to over 170,000 gpd., are of record to date. Obviously it would be impracticable to expect a processing cycle, accurately adjusted to accommodate a loading of 120 pounds, to accommodate a sudden overloading of 1,400 pounds.

In treatment works subjected to a wide range of loadings of this order, it is considered practicable to maintain the sludge in a condition exhibiting an "Oxidation Index" in excess of 100 per cent. Graph 2 illustrates the settling rate of the sludge at the Mead Johnson plant on July 9th, a few days after the tanks were filled and operations commenced. It will be evident from the concentration curve shown, that the sludge was under-oxidized (Oxidation Index 84%). The plant was producing a "sparkling clear" effluent at the loading and flow rates on that date, but an increased loading would undoubtedly have caused turbidity and a consequent depreciation of the effluent. The loading on this day was approximately 680 pounds of B.O.D., which was just barely accommodated by mixed liquor of the volume, concentration and "Oxidation Index" as shown. While complete records are



Graph 2.—Curves Indicating Plant Conditions—July 9, 1941.

not available, it was observed on the following day that an overload did, in fact, cause some turbidity in the first clarifier supernatant liquid.

Graph 3, from which the settling curves have been omitted for clarity, exhibits the sludge concentration rate and corresponding "Oxidation Index" of the sludge at about 8:00 a. m., 1:30 p. m. and 4:40 p. m. on August 6th. At 8:00 a. m. the mixed liquor concentration by standard centrifuge test was 4.4 per cent. The concentration rate indicated a relatively high "Oxidation Index" (136%), representing a mechanism which would provide adequate accommodation for substantial overloads. During the morning, a substantial volume of whey was delivered to the aerator, representing a loading of 800 to 900 pounds of B.O.D. The total loading during the normal daily loading period from 7:00 a. m. to 3:00 p. m. was approximately 1,435 pounds. The measurable effect of the heavy overload discharged to the aerator during the short period in the morning, will be evident from the depreciation in the sludge concentration rate, as indicated by the 1:30 p. m. concentration curve and corresponding "Oxidation Index" (115%). The remarkable ability of this process to accommodate sudden overloads of this order without visible disturbance, to the process and with minor measurable changes as shown, is further augmented by the demonstration of its ability to begin promptly the process of restoration of initial conditions. It is axiomatic that a loading representing an oxidation demand in excess of the oxidizing capacity of the cycle, will be reflected in a decrease of the "Oxidation Index." Conversely, the "Oxidation Index" will increase during periods of loading in which the oxygen demand represented by the total load is less than the oxidizing capacity of the cycle. As indicated by the 4:40 p. m. concentration curve, the heavy morning loading had been accommodated and the oxidation demand fully compensated, and, during the several hours following the peak load discharge, the sludge exhibited substantial progress in restoring its original degree of oxidation. The "Oxidation Index" as shown, increased from 115 per cent at 1:30 p. m. to 132 percent at 4:40 p. m.

It may be noted that no consideration of the residual load factors is included in these comments. These factors are elements of concern to the designer only, and cannot be modified by the operator, once they are incorporated in the plant characteristics.

It is possible to carry the degree of compensation to great extremes by appropriate manipulation. Graph 4 illustrates the sludge settling and concentration rates on October 27th and November 22nd respectively. It will be observed that the mixed liquid solids concentration on October 27th was 7.7 per cent by standard centrifuge test. The suspended solids concentration by weight, as determined by test, was in excess of 7,000 ppm. The observed concentration rate exhibited a settled sludge concentration of approximately 28.5 per cent, corresponding to approximately 28,000 ppm. by weight. This particular sludge exhibited a reasonably rapid settling rate. The computed optimum sludge concentration was approximately 24.8 per cent. An observed settled sludge concentration of 28.5 per cent represented an "Oxidation Index" of 115 per cent. The waste flow on this date was 65,200 gallons or approximately 65 per cent of the normal full load flow rate for which the plant was designed. The B.O.D. loading was 1,165 pounds or 16 per cent overload. In these circumstances, it was characteristic that this degree of oxidation would be associated with an excellent effluent.

The sludge on November 22nd exhibited an extremely rapid settling rate with a corresponding increase in the concentration rate. On this date the waste flow through the treatment cycle was approximately 49,800 gallons, or approximately 50 per cent of the full load flow rate for which the treatment works was designed. The B.O.D. loading was 474 pounds, or 47 per cent of the designed full load capacity. In this circumstance, some underload turbidity in the clarifier effluent is to be anticipated. A substantial overload would, however, promptly clear it. On this date, as shown on the graph, a mixed liquor sludge concentration of 4.0 per cent increased to a settled sludge concentration of 40.0 per cent, corresponding to approximately 40,000 ppm. by dry weight. The observed concentration 40 per cent, as compared to a computed optimum concentration of 12.88 per cent, represented an "Oxidation Index" of 310 per cent. In this circumstance, the process was capable of accommodating an overload somewhat in proportion to the degree of oxidation, namely, 200 per cent overload, during one diurnal period. In this respect the "Oxidation Index" is of additional practical value, as, within practical limits, the shock overload capacity of the plant may be regarded as somewhat comparable with the degree of over-oxidation.

Tests in Practical Plant Operation Simple

In practical plant operation, the required tests are simple, quickly performed, and readily converted into appropriate control measures. A specimen of mixed liquor is settled in a two-liter standard "Settlometer" to determine the settling rate and corresponding sludge volume. A specimen of the same mixed liquor is tested by the "Standard Centrifuge Test" to determine the concentration.

(These tests, and equipment involved, have been described in "Water Works and Sewerage" for August 1941—"The Oxidized Sludge Process and the Equilibrium Index.")

During the several weeks period of whey delivery to the aerator to provide test loads, it was also the practice to determine the pH of the mixed liquor once or twice daily. Whey exhibits an average pH of 4.6 and first curd wash water a pH of 5.1. It has been observed that, under normal operating conditions, the mixed liquor consistently exhibits a pH of 7.3 or 7.4. The delivery of acid whey and first curd wash water in quantities up to 9,000 and 10,000 gallons per day, was adequately buffered by the sludge in the mixed liquor, with the result that the pH declined only 1 or 2 tenths at the time of acid whey loadings, and promptly recovered its initial value a few hours later.

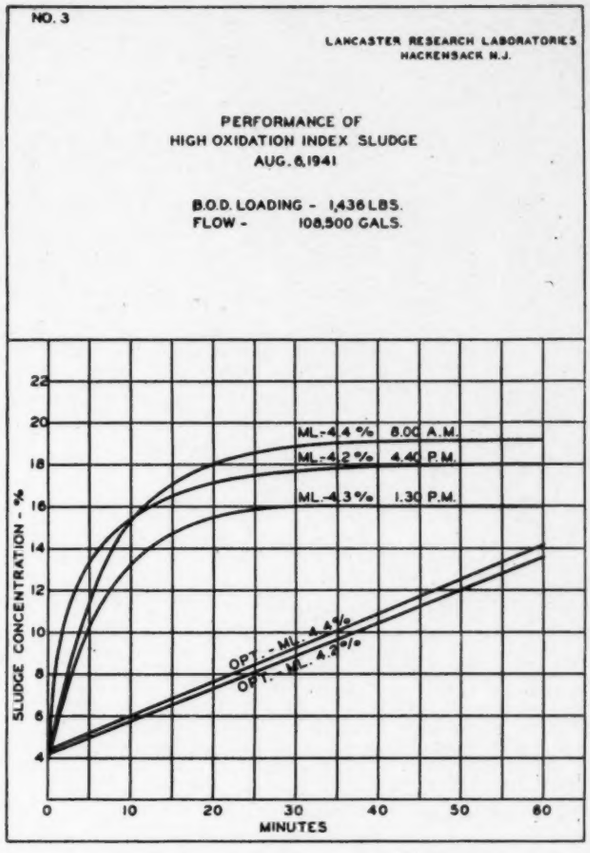
The tremendous oxygen demand in these wastes (B.O.D. range 20,000 ppm. to 60,000 ppm.) similarly suggested the desirability of determining the dissolved oxygen concentration in the mixed liquor once or twice daily. The normal dissolved oxygen concentration of the mixed liquor may vary from 1 to 3 or 4 ppm. in warm weather up to 6 or 8 ppm. in cold weather, dependent upon load conditions.

Peak overloads of high oxygen-demanding wastes, such as whey and curd wash waters may reduce the dissolved oxygen concentration to 1 ppm. or less during the period of discharge, but in this instance also, the initial dissolved oxygen concentration is rapidly restored during the first few hours after the discharge of the high oxygen demanding wastes.

It is believed that industrial waste treatment works should be designed to require a minimum of attention and control, and be as nearly automatic as possible. The principal and practically sole secondary process control employed by the operator at this substantially automatic plant is the proper discard of excess sludge from the system. The required extent of this operation is revealed by the simple centrifuge and settling tests.

Exploration into the fate of the solids delivered to the Oxidized Sludge Process discloses some interesting facts. Over 60 per cent of the volatile dissolved solids are either volatilized or converted to suspended solids. The fixed suspended solids are increased 7 or 8 times and the total suspended solids more than doubled. These suspended solids increments appear in the sludge. Excess sludge is discarded 3 or 4 days weekly at rates varying from 2 per cent to 7 per cent of the waste flow rate, averaging about 4.5 per cent.

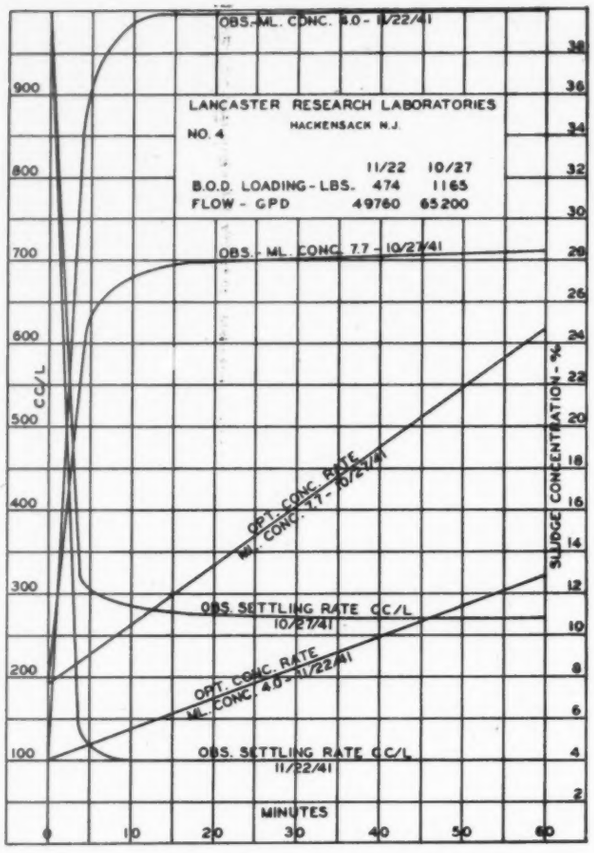
In the absence of any foreknowledge of probable load conditions, as governed by the manufacturing plant program, the operator wisely maintains appropriate quantities of sludge in the treatment cycle at a reasonably high "Oxidation Index," as an insurance against disturbance of the process by unexpected peak loadings. With a foreknowledge of load conditions, however, the operator may adjust the mixed liquor concentration and "Oxidation Index" to any desired



Graph 3.—Concentration Rate and "Oxidation Index" Curves—Aug. 6, 1941.

value by the discard or accumulation of sludge in the system, as dictated by the centrifuge and settling tests.

This particular plant has been subjected to overloads one or two days weekly, but generally these overload periods have been separated by an interim of several days of regained "Oxidation Index" to serve as a back-log. In these circumstances the observed variation of the "Oxidation Index" and settling rate was within the range exhibited in Graph 3. Should the mixed liquor concentration and "Oxidation Index" be lowered to a value less than required by such overloads, and such overloads be of continuous occurrence, both the rate of concentration and the "Oxidation Index" would gradually decrease. It is of course possible to continue this decrease to values lower than exhibited in Graph 2. Should this trend be continued further for several consecutive days, the observed concentration curve would become definitely concave and below the optimum straight line, and, if decreased to an extreme degree, sludge bulking would occur. As previously reported, however, and as evident from the above, adequate knowledge of process conditions may be accurately determined from day to day and the operator need experience no difficulty in maintaining the process at or above equilibrium, as represented by an "Oxidation Index" at or above 100 per cent, up to the full load capacity of the plant. When under-oxidation is determined by the prescribed tests and computations, as a result of operation neglect, or excessive overloads, an additional control may be employed by the operator, i.e., increasing the volume of applied air for a short period until equilibrium is again established. In general it may be said, that


OBS. ML. CONC. 8.0 - 11/22/41
LANCASTER RESEARCH LABORATORIES
NO. 4 HACKENSACK N.J.
11/22 10/27
B.O.D. LOADING - LBS. 474 1165
FLOW - GPD 49760 65200
OBS. ML. CONC. 7.7 - 10/27/41
OPT. CONC. RATE ML. CONC. 7.7 - 10/27/41
OBS. SETTLING RATE CC/L 10/27/41
OPT. CONC. RATE ML. CONC. 4.0 - 11/22/41
OBS. SETTLING RATE CC/L 11/22/41
MINUTES
CC/L
SLUDGE CONCENTRATION - %

Graph 4.—Sludge Settling and Concentration Rates—Oct. 27 and Nov. 22, 1941.

under similar total loading conditions it requires the expenditure of more power to restore a process to equilibrium than is required to maintain equilibrium. This suggests the economy of properly controlled operation.

The Regenerative Digester

The Regenerative Digester is a circular reinforced concrete tank 76 feet in diameter with a water depth of 13.5 feet and consists essentially of a high temperature zone at the center, which is surrounded by a concentric arrangement of medium and low temperature zones. (See Fig. 1.) The medium and low temperature zones are divided into three compartments each, through which the wastes travel in sequence in passing through this unit. Consonant with the principles hereinbefore enunciated, no sludge scraping, scum breaking or other mechanical equipment is employed in this unit other than the disturbance created by the moderate introduction of air.

A heater of greatly increased efficiency, as compared with conventional practice, is provided in the form of a vertical, cylindrical, steel tank filled with clear water. This unit is located at the center of the high temperature zone, i.e., tankcenter. No horizontal surfaces or protuberances are present on the heater to accumulate deposits of sludge solids. The surface is continuously clean and maintains its initial heat transfer efficiency. The entire surface of the heater is at an uniform temperature, thereby distributing heat at an uniform rate throughout the liquid column of the digester unit. This makes practicable a heater surface of less than half the area required when pipe coils are employed. The temperature gradient from the heater water at 110 to 115 degrees F. to the exterior walls of the digester at about 75 degrees in Winter and 90 degrees in Summer, is substantially a straight line.

Waste steam, from the exhaust of the turbine in the engine room of the manufacturing plant, is delivered at 3 pounds pressure and jetted into the clear water contents of this tank, providing direct expansion and heat transfer without loss at the point of transfer. Condensate overflows from the heating cylinder into the high temperature zone. In view of the low pressure and to insure the uniform temperature of the tank contents, air lifts are provided to recirculate the contents of the heater tank during periods of steam application. The delivery of steam to this unit is controlled by conventional thermostats and motorized valves. The heater recirculation air lift controls are synchronized with, and operated by, the steam controls. Selected sludge recirculation air lifts are also synchronized with the steam controls.

Incoming wastes are delivered to the high temperature zone at a point contiguous the discharge of the recirculating air lift adapted to deliver concentrated sludge from the bottom of this zone to the surface at the point of waste inflow. An additional air lift is provided to recirculate sludge from the final compartment of the medium temperature zone for admixture with the raw wastes and contents of the high temperature zone. Fixed diffusers are provided in all compartments of this digester adapted to agitate and mix thoroughly the contents of each compartment and further adapted to provide the amount of oxygen required to serve the processing requirements—i.e. activation of the degredation process, which has earlier been referred to as "activated sludge" in fact. Additional air lifts are provided to recirculate sludge between other selected compartments. All diffusers and air lifts are individually removable from the top of the digester for inspection or cleaning.

Mechanism of the Process

A word about the mechanism of this process is perhaps pertinent. It is believed that the products of digestion in conventional digestion tanks reach sufficient concentrations to inhibit higher rates of digestion which might otherwise be possible. These products of digestion may be enzymes, bacteriaphages, inhibiting volatile acids or other toxic elements. It has been found that these products of digestion may be destroyed or restrained and the activities of certain organisms greatly increased by the proper application of oxygen. It has also been found that the principal factor generally credited to the "Activated Sludge Process"—the admixture of so-called "Activated Sludge" with the incoming raw wastes, is of practical value. It is believed that this regenerative digestion process as now exemplified, may perhaps properly be considered an "Activated Sludge Process." Sludge in which a high concentration of active organisms has been developed and maintained is mixed with the incoming raw wastes by means of air lifts, which, in addition to providing the necessary degree of mixing, also necessarily introduces quantities of energizing oxygen.

The recirculation of more highly activated sludge from subsequent zones to the initial zone is also employed. Sludge recirculation is employed in this process, however, at relatively high temperatures and under conditions which are generally anaerobic, as

it is found that the applied oxygen is rapidly dissipated and that anaerobic conditions are in fact generally maintained. It is also found that sludges exhibiting a substantially higher degree of activity may be cultivated and maintained. More particularly, it will be observed that this process is susceptible to definite and ready control and that the maximum efficiency may be maintained reliably and consistently.

But Little Gas Generated

Compared with conventional digesters, very little gas is developed in this unit. This is well confirmed by the absence of the usual scum formation or the rising and falling of sludge particles through the liquid contents. During periods of quiesence the sludge settles, leaving a clear supernatant liquor, even in the high temperature zone, which enables the operator to determine the volume of sludge in any compartment by the use of an ordinary sludge "blanket" finder. The small amount of gas occurring is discharged to the atmosphere through an elevated vent. An aspirator operated by compressed air is provided to evacuate completely all gases when desired.

It is problematical when and to what extent digested sludge may be removed from this unit. To date the rate of liquefaction and volatilization has paralleled the rate of solids loading.

Provision has been made to divert raw milk wastes directly to the digester to maintain an adequate amount of sludge and active organisms during the period when whey and curd wash waters are not produced in the manufacturing plant.

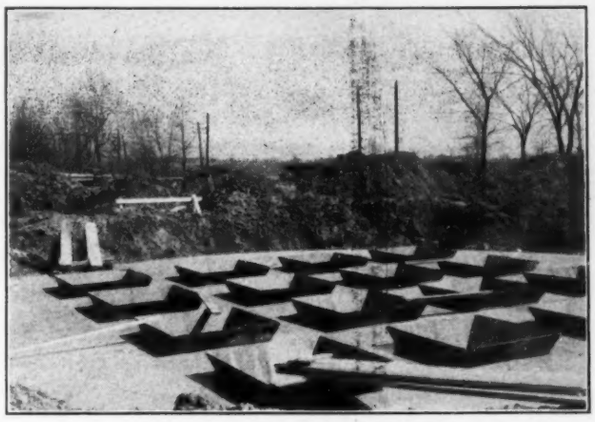
Regenerative Digester Control

Numerous complicated and time-consuming tests in the chemical laboratory are at times observed in efforts to provide limited control of conventional digestion units.

At Zeeland, the complete control of the Regenerative Digester, paralleling the degree of control evident in the secondary, or Oxidized Sludge Process, is accomplished with the aid of one simple test, the pH value observed in the high temperature zone. The actual manual control, in addition to the automatic heat and recirculation controls, is equally simple and consists of opening or closing ½ inch air valves to provide appropriate recirculation or diffusion.

During extended periods of the year when whey is not regularly produced, a high pH accompanied with a low volatile solids concentration in the high temperature zone serves as a guide to suggest the diversion of raw milk wastes directly to the Regenerative Digester, to maintain food balance and the activity and concentration of the animal inclusions in the sludge. An acidity-alkalinity gradient somewhat paralleling the temperature gradient, indicated by pH values of 6.8 to 7.2 in the high temperature zone increasing to pH 8.0 to 8.5 in the final compartment, is also automatically maintained in a substantially straight line. For all practical purposes, pH tests of the medium and low temperature zones once weekly are generally sufficiently informative.

Parenthetically, it may be appropriate to remark that another page has been taken from the physiologists' lexicon. It has been found that digestion, an animal process, may proceed more rapidly and to a more complete degree in an initial moderately acid environment, progressively developing an increasing



Construction of Aerator-Clarifier.
(Foundation slab with lower sections of steel hoppers in place.)

alkaline environment in succeeding stages, with a parallel initial temperature somewhat higher than conventional practice, which is progressively decreased in the subsequent zones.

The recirculation of sludge from the third compartment of the medium temperature zone is desirable at times as a buffer to maintain proper pH conditions in the high temperature zone when large amounts of highly acid loads are delivered to this zone. The administration of air also aids in dissipating promptly the volatile acids which contribute to undesirably low pH conditions.

To provide some idea of the amount of aeration required in this unit, it may be remarked that the high temperature zone air lift recirculator is turned on by one of the workmen in the manufacturing plant shortly before the first batch of whey is delivered to the regenerative digester. This recirculator is continued in operation throughout the day until after the last batch of whey or curd wash water has been delivered to this unit. The air lift providing recirculation of sludge from the third compartment of the medium temperature zone into the high temperature zone, is controlled by the plant operator, and may be operated for an hour to four or five hours per day, and frequently not at all. The diffusers in the high temperature zone similarly may be operated during the period of discharge of whey and curd wash waters to this unit, to aid in the thorough and prompt admixture of the raw wastes and activated sludge. The diffusers in the second compartment of the low temperature zone are operated continuously. The digester effluent from the final compartment of the low temperature zone flows by gravity to the main sump in the pumping station and is pumped with the raw general waste, of medium concentrations, to the aerator for complete treatment.

Plant Performance

It has been previously stated that the performance of the "Oxidized Sludge" or secondary process, at Zeeland, Mich., must be maintained consistently at an efficiency in excess of 99 per cent. The designed full load rating of the secondary process is 1,000 lbs. of B.O.D. per day at an average flow rate of 100,000 gpd. During a three weeks' secondary process acceptance test period last summer, raw waste flow rates varied from 24,000 gpd. to 76,000 gpd., averaging 42,000 gpd. B.O.D. concentrations varied from

410 ppm. to 2,400 ppm., averaging 1,100 ppm., representing loadings of 20 per cent to 140 per cent of the designed full load rating. The effluent B.O.D. concentration varied from 1 ppm. to 12 ppm., averaging 3.7 ppm., representing an efficiency of 99.7 per cent. The dissolved oxygen concentration varies from about 6.0 ppm. in the summer to over 9.0 ppm. in the winter. The pH holds rather steady at about 7.5. When chemicals have been employed experimentally in the final stages the pH increased to over 8.0.

For the period November 1st to this writing (January 1942), the plant operator's daily log record indicates the following plant effluent characteristics:

	Range	Average
Suspended Solids ppm.....	1-7	3
Turbidity ppm.....	10-20	12
B.O.D. ppm.....	3-10	5
Dissolved Oxygen ppm.....	7.4-9.6	8.4

Flow rates varied through the wide range of 11,800 to 90,500 gpd. The raw waste B.O.D. concentration has averaged 1,260 ppm. The aeration period has averaged about three hours and the first clarifier detention period has averaged about 1 hour. The mixed liquor suspended solids concentration has varied from about 3,500 to 9,500 ppm. dependent upon loading conditions.

The designed full load rating of the Regenerative Digester is 2,000 lbs. of B.O.D. per day. This is based on a total liquid detention period of 12 days, in the active digester zone, a volumetric holding capacity of 13 cubic feet per pound of B.O.D. per day, and wastes having a maximum acidity concentration of 3,500 ppm. or a minimum pH of 4.0.

During the past several months since the Regenerative Digester has accumulated a sufficient volume of well-activated sludge solids to accommodate the whey and wash water loadings for which it was designed, various daily loadings up to approximately 10 per cent overload have been delivered to this unit.

The characteristics of the digester effluent may appear somewhat startling to those long experienced in the operation of conventional digesters.

The acid wastes have been adequately buffered as evidenced by a pH range of 6.6 to 7.2 in the high temperature zone. The effluent pH is consistently 8.0 to 8.5, while the suspended solids and B.O.D. concentrations are consistently less than 50 ppm. in the digester effluent. This represents a B.O.D. reduction efficiency in excess of 99 per cent. After a unit of this type has been in full operation for several months, the effluent becomes colorless and exhibits a turbidity as low as 25 or 30 ppm. It is evident that the tremendous B.O.D. reduction in this process results in an effluent which represents little or no load on an associated aerator-clarifier unit, and one suitable for discharge into many receiving streams without further treatment. It seems quite feasible and practicable to employ this digestion process as the sole method of treatment when wastes of relatively high concentration are encountered and receiving stream requirements are within the range of the effluent characteristics which may be delivered from this type of process.

Design Summary

It is believed the Mead Johnson treatment works represents the first parallel, interacting process plant devised for the treatment of diversified wastes. It is submitted that a process grouping of this character may readily meet the most rigid receiving water or other requirements.

It may be thought that the extremely high treatment efficiency may only be accomplished at equally high costs. Quite the contrary. The total cost of the plant described, on a per capita loading basis, was approximately $3.50 ($22 per pound of B.O.D. capacity) which compares very favorably with the best municipal plants. The simplicity of design and the prefabricated features of construction contributed greatly to this low cost and also made possible the completion of erection and the beginning of operation of this plant and the delivery of an effluent meeting the receiving stream requirements, in less than four months from the date of contract. The structures are relatively small and simple when compared with conventional plants of comparable load reducing capacity.

Operating costs are similarly substantially lower than the cost of reducing an equivalent loading in the same degree of efficiency in conventional plants.

The main waste pumps represent a load of 1 HP for an average of about 6 hours daily, or a load of 6 HP hours per day. A compressor represents a continuous load of about 21 HP or 504 HP hours per day. This would represent a total power load of about 510 HP hours or a cost of $10.20 per day at a purchased power rate of 2 cents per K.W.H. This will be substantially lowered by the use of power from the manufacturing plant generating equipment. At the rated full load of 3,000 lbs. of B.O.D. per day, the ratio of B.O.D. to power demand is 17 lbs. of B.O.D. per HP hour, equivalent to a power cost of $6.80 per ton of B.O.D. Charging the full expense of an operator, who however devotes a portion of his time to other duties, at $4.00 per day, the total operating cost is $14.20 per day, or $9.47 per ton of B.O.D. removal at full load. Charging off interest, maintenance and depreciation, at a generous total of $20.00 per day, the total cost of B.O.D. removal is less than $23.00 per ton, a small fraction of the total costs at many municipal plants of much lower efficiency.

The opinion has been expressed that a treatment works should preferably incorporate a single process and a minimum of stages to accommodate combined wastes requiring treatment. It is submitted that waste segregation and the adoption of dissimilar processes best adapted to the treatment of each class of waste, may be suitably interrelated in many instances to provide an economical and extremely efficient method of treatment, and more particularly, to provide a degree of reliability and an insurance against aperiodic or seasonal stream pollution, impossible of accomplishment in single process treatment works except at greatly excessive costs.

It is not the desire to provoke controversy, nor to urge acceptance of the logic exhibited in the terminology and interpretations of processing characteristics recited. It has been previously suggested that the aeration-sedimentation method of treatment is, in effect, an oxidizing process, and that the amount of effective work contributed by the living organisms is an unknown and ungovernable consideration. Predicated on this belief, the term "Oxidized Sludge Process" has been suggested as a more appropriate term for this type of process.

In advancing the philosophy exhibited in the description of the Regenerative Digester, it is suggested that the process cycle exemplified in the plant described and in other processing units of similar character does,

in fact, warrant the descriptive term "Activated Sludge Process," as it is clearly evident that the major degree of energy expended to accomplish work in this process is represented by the efforts of the active organisms, and that the character, concentration and condition of these organisms and environmental influences created by appropriate recirculation and oxygenation, are governing factors in the rate and degree of the work accomplished.

A B.O.D. reduction efficiency in excess of 99 per cent in Oxidized Sludge Process plants is not a new accomplishment. This efficiency has been consistently exhibited by other plants of this type during the past several years. However, a digestion tank exhibiting a B.O.D. reduction efficiency of 99 per cent may be novel. Perhaps the efficiency of the Regenerative Digestion Process may represent another milestone in the art of waste treatment and provide a reliable method of treating difficult wastes and sludges at greatly increased efficiencies and place at the command of State Health authorities another powerful weapon to combat stream pollution.

Some Comments on the Mallory Process*

(A Discussion)

By E. F. ELDRIDGE
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THE waste treatment plant at the Mead-Johnson Co., Zeeland, Mich., is of general interest for a number of reasons. First, it is perhaps the largest milk waste treatment unit in the world. Second, it demonstrates a system of control of the activated sludge process ("Oxidized Sludge" process) which seems to assure successful operation and an almost perfect effluent under widely varying loads and with greater loadings than have been considered possible heretofore. Third, it introduces an innovation in anaerobic digestion, and demonstrates the possibility of almost complete treatment of high concentrated wastes by the regenerative digestion process alone. Fourth, it establishes the desirability of complete treatment for industrial wastes.

I wish to elaborate briefly on the last three of these items.

I have observed the operation of activated sludge plants for a good many years and when this process was proposed for the treatment of the Mead-Johnson wastes I was extremely doubtful of its success. The mathematical control which Mr. Mallory has discussed in his paper appeared interesting, but I confess that I was skeptical at first. However, I have followed the operation of the Zeeland plant and I can, without reserve, state that it really works under the most extreme and exacting conditions.

Mr. Mallory has not sufficiently emphasized the negligible effects created by the application of acid whey and curd washings direct to the activated sludge unit. These applications were not continuous, in which case the sludge could have been gradually developed to handle the load. The intermittent loadings necessitated the maintenance of an over-compensated (oxidized) condition at all times. This range of loadings is demonstrated by the load applied on six consecutive dates, August 11 to 16 inclusive. The daily loads in respective order were 121, 440, 1183, 1388, 331, and 170 pounds of B.O.D. The effluent B.O.D. concentrations on the same dates were 1, 4, 12, 3, 2 parts per million, respectively.

The pH of the acid whey is 4.5. The buffering action of the mixed liquor is such that the addition of as much as 4,000 gallons of whey, and the three curd washings, a total of 16,000 gallons of curd wastes, resulted in a lowering of the mixed liquor pH of about 0.2.

Ability to Stand Shock and Over-Load Impressive

Some may question the ability of the mixed liquor to handle this whey load on consecutive days. From October 21st to 25th, 8,800 gallons of whey were added on each of four of the five days. The pH dropped from 7.5 to 7.4 only, and the effluent B.O.D. increased from 2.7 to 3.6 ppm. only. Obviously we can say there was no apparent effect on the effluent. What activated sludge plant of a 6,000 population equivalent capacity could take an acid overload of this kind without a complete break-down of the process? I can fairly see the sludge passing over the effluent weir.

The regenerative digestion process at Zeeland has developed to a point where it now successfully handles all of the whey and excess sludge load for which it was designed. Acid fermentation of organic material is not new. The effect of acid concentration on organism activity has been known, and the oxidation of organic acids has been practiced in waste treatment. Mr. Mallory has succeeded in combining these factors in what has the possibility of a complete treatment digestive process. Water clear digester supernatant liquor with B.O.D. and suspended solids concentrations below 50 ppm. is rare in general practice. However, this is what the Zeeland digester produced.

Just a final word about the desirability of complete treatment of industrial wastes:

The Mead-Johnson Co. now have a waste treatment plant which will meet their needs for almost any degree of factory development. The officials of this company take great pride in exhibiting the water clear non-putrescible effluent from this plant. Too many times industries have been persuaded to install units which have produced effluents proving to be below the requirements of the stream. The operation of these units has not been a source of satisfaction to anyone and has too often resulted in unpleasant relations between plant officials, State officials, and the designing engineer. So, when considering all interests and the net attainments, it is my personal opinion that we should aim to secure the *best possible effluent* rather than one that may be expected to "get by" because of local dilution conditions. Close observations of operation and results from the Mead-Johnson installation has gone far to strengthen this opinion.

*Presented before the Sanitation Group of the Am. Soc. of Mechanical Engineers, New York City, January 20, 1942.

THE SLUDGE TRIANGLE PROCEDURE

A Rapid Method for Determining Sludge Solids

By GEORGE E. SYMONS
and STEPHEN R. KIN
Chief Chemist and Assistant Sanitary Chemist
BUFFALO SEWER AUTHORITY
BUFFALO, N. Y.

This simplified method for determining the solids content of sewage sludges rapidly has been found highly useful by those operators who have put it to use.

Although the procedure was given in an earlier article by the same authors in our January, 1942, issue, it was not in such readily usable form as is the present procedure.

In consequence, and to make this very simple method of sludge solids determination available to the greatest number—in particular the small plant operators—we have asked Dr. Symons and Mr. Kin to prepare this article which gives the procedure direct.

IN the January, 1942, issue of WATER WORKS AND SEWERAGE[1] there appeared a discussion of "The Sludge Triangle" as a key to a rapid method for determining sludge solids. In order to make that technique more readily available, this article has been prepared. The theory, experimental development and results are to be found in the original article[1] and, therefore, are being omitted. But, as an introduction, facts drawn from the previous article are presented.

1. It is possible, by use of a special "sludge triangle" graph, to estimate *any two* characteristics of a sludge if the volume of filtrate liquor from laboratory vacuum-filtration of a chemically treated sample, and *one* other characteristic, are known. These characteristics are per cent solids, per cent volatile matter and specific gravity.
2. The method for determining the solids content of a sludge depends on the treatment of a measured sample of sludge with known quantities of lime and ferric chloride, measurement of the volume of filtrate resulting from vacuum filtration of the treated sample, and determination of the specific gravity of the untreated sludge sample. It is possible to perform both tests in ten minutes, after which the total solids and volatile matter content can be estimated with a reasonable degree of accuracy through use of a graph known as the "Sludge Triangle."
3. The per cent solids content may also be estimated from volume of filtrate or specific gravity, if the approximate volatile matter content of the sludge is known. Or, the volatile matter may be estimated from the volume of filtrate liquor or specific gravity, if the total solids content is known. And, specific gravity may be estimated, if total solids and volatile matter content are determined.
4. This simple method is particularly advantageous in plants using chemical conditioning of sludge where the quantity of conditioning chemicals used is dependent to some extent on the volume of water associated with the sludge and/or its content of volatile matter.

Procedure

Filtrate Volume

Measure 200 ml. of well-mixed sludge in a 200 ml. graduate (calibrated to deliver 200 ml. volume of water). Pour the sludge into a 400 ml. beaker that has been rinsed with water and drained, but not dried.

Add 10 ml. of lime regent containing 0.1 gram of available CaO per ml. Mix well with a flat policeman. Add 5 ml. of ferric chloride reagent containing 0.1 gram of $FeCl_3$ per ml. Mix again.

Place a No. 615 crepe surface filter paper, or equal, on a 3½ inch Buchner funnel, and insert the funnel in a 500 ml. filtering flask. Wet the filter paper with water, apply vacuum until the free liquid has been removed from the funnel, then empty the filter flask.

Pour the conditioned sludge into the Buchner funnel, using a flat rubber policeman to remove drops of the sludge sample adhering to the walls of the beaker.

Apply the vacuum to the flask. When the break-through of air is noted, carefully press the surface of the filter cake with the flat top of a mushroom stopper, or other flat object, in order to close cracks in the cake and secure full effect of the vacuum. Maintain the vacuum and continue pressing the cake until the rate of passage of liquor through the Buchner funnel is less than one drop every five seconds. To continue the vacuum beyond this point may produce and evaporation of liquid sufficient to interfere with the accuracy of the test.

Pour the filtrate from the vacuum filter flask into a 200 ml. graduate (preferably the same as used in measuring the original sludge), and note the volume of the filtrate liquor.

Determination of Specific Gravity

For the determination of specific gravity use a 500 ml. Erlenmeyer flask to reduce the error attendant with use of smaller samples. Into the neck of the Erlenmeyer flask insert a special rubber stopper (made of a No. 7, one-hole stopper and half of a No. 5, one-hole stopper, as shown in Fig. 1). Weigh on a laboratory torsion balance, to the nearest 0.5 gram.

To determine the specific gravity, pour a well mixed sample of sludge into the tared Erlenmeyer flask and stopper it, forcing excess sludge out through the glass tube. Rinse the outside of the flask. Hold a finger over the end of the glass tube and shake the Erlenmeyer flask in a vertical plane with a rapid upward motion and a slow downward motion. This technique increases gravitational force and causes small bubbles, entrapped in the sludge, to rise to the top. After shaking about 50 times in this manner, remove the

special stopper and add sludge to the flask until full. Replace the stopper in the flask and force out excess sludge. Wash the Erlenmeyer flask, wipe the outside and weigh. The weight of the sludge divided by the weight of the same volume of water required to fill the flask is the specific gravity.

Use of the Sludge Triangle

From experimental study, it was possible to show the inter-relation of all factors affecting the release of water from a chemically treated sludge; namely, per cent solids, per cent of volatile matter and specific gravity, as related to ml. of filtrate obtained from the sludge that had been treated as described above. The data, when plotted, produced lines within a wedge shaped triangle. This graph, designated "The Sludge Triangle," is shown in Fig. 2.

The useful applicability of "The Sludge Triangle" depends upon its accuracy when compared to the present standard method[2] of evaporating samples to dryness and weighing. To obtain such a comparison, the proposed method was run in parallel[1] with the standard method for a period of 28 days.

This comparative study indicated the average error in total solids by the new method to be only 0.02 per cent of the standard method. (This agreement is somewhat surprising since the proposed method actually determines the suspended and flocculatable solids, and does not include the dissolved solids in the expressed liquor. Total solids should be at least 0.1 to 0.3 per cent higher because of this dissolved matter.) In the estimation of volatile matter content, "The Sludge Triangle" is less accurate. The average error during the four-week period was 2.43 per cent, with wider variations in individual samples than in the case of total solids. It appears that the errors are greater when the concentration of solids is below 3 per cent.

These errors are based on the assumption that the standard method is correct. However, considering the difficulties of sampling sludges for the determination of total solids and volatile matter (by evaporation and ignition), it is not surprising that there are some differences between the two methods. It has been shown that sampling[3] is important in sludges of this type.

Variations in Technique

(1) In special cases, it was found that certain variations in technique could be employed. For example, when the solid concentration is above 8 or 10 per cent, and a sample of sludge does not pour cleanly from a graduate in which it is measured, the graduate may be rinsed out with a 20 ml. of water from a pipette and the rinse water poured into the beaker containing the sludge to be conditioned and filtered. After the filtration, 20 ml. is subtracted from the volume of the filtrate readings in order to give the filtrate volume from the original sludge.

(2) Where greater accuracy of measurements is desired, it is possible to weigh the original sample of sludge and then weigh the graduate or beaker from which it is poured into the Buchner funnel. This difference in weight when corrected for specific gravity will give the actual volume of sludge conditioned and filtered. Inasmuch as the test depends upon the use of a standard 200 ml. sample, any variation from that volume, as determined by difference in weight, according to this method can be applied to the filtrate volume reading in order to produce a correct reading.

(3) For sludges of greater than 8 per cent solids, the gravity may be determined by diluting the sample with an equal volume of water. This procedure simplifies the removal of entrained air bubbles. In this case the specific gravity of the original sludge is calculated according to the equation:

$$(\text{Sp.G.} - 1) \times 2 + 1 = \text{Sp.G. of original sludge}$$

This technique will eliminate some of the objections to the determination of specific gravity cited by Smith.[4]

(4) To further simplify the technique, and increase the accuracy

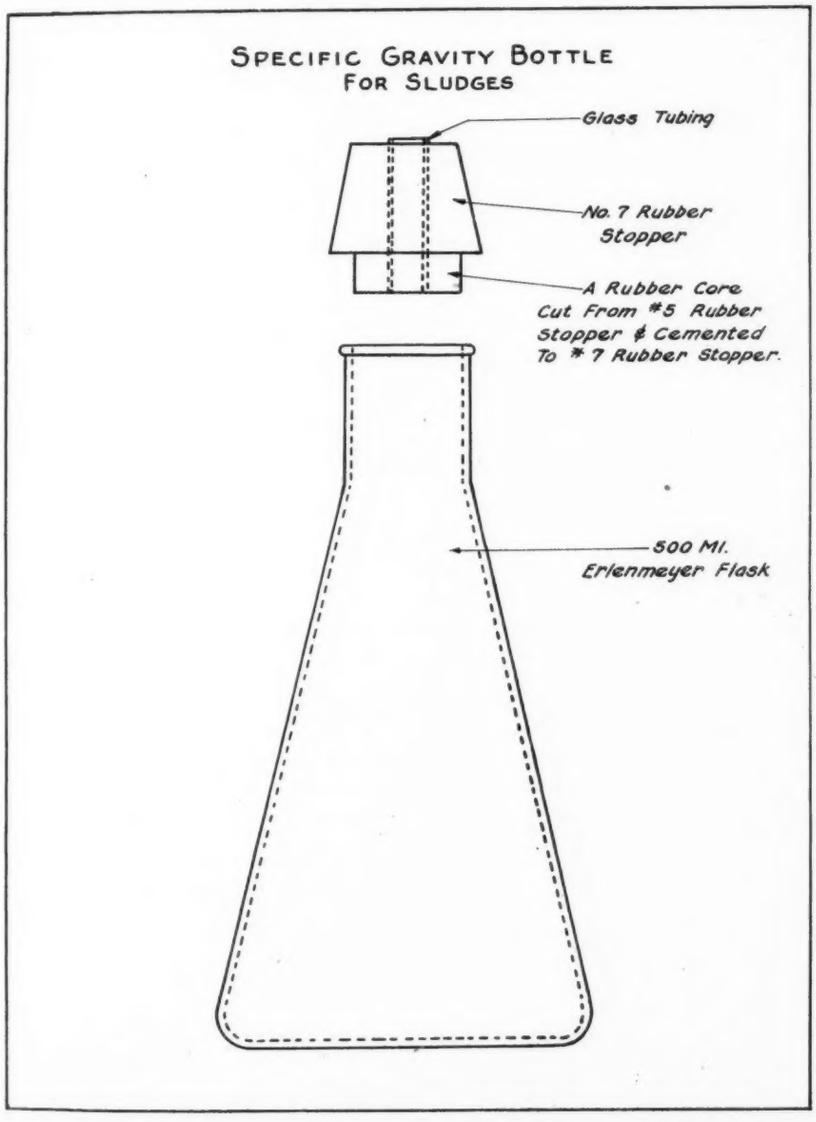

SPECIFIC GRAVITY BOTTLE
FOR SLUDGES
Glass Tubing
No. 7 Rubber Stopper
A Rubber Core Cut From #5 Rubber Stopper & Cemented To #7 Rubber Stopper.
500 Ml. Erlenmeyer Flask

Fig. 1.—Flask for Determination of Specific Gravity of Sludges.

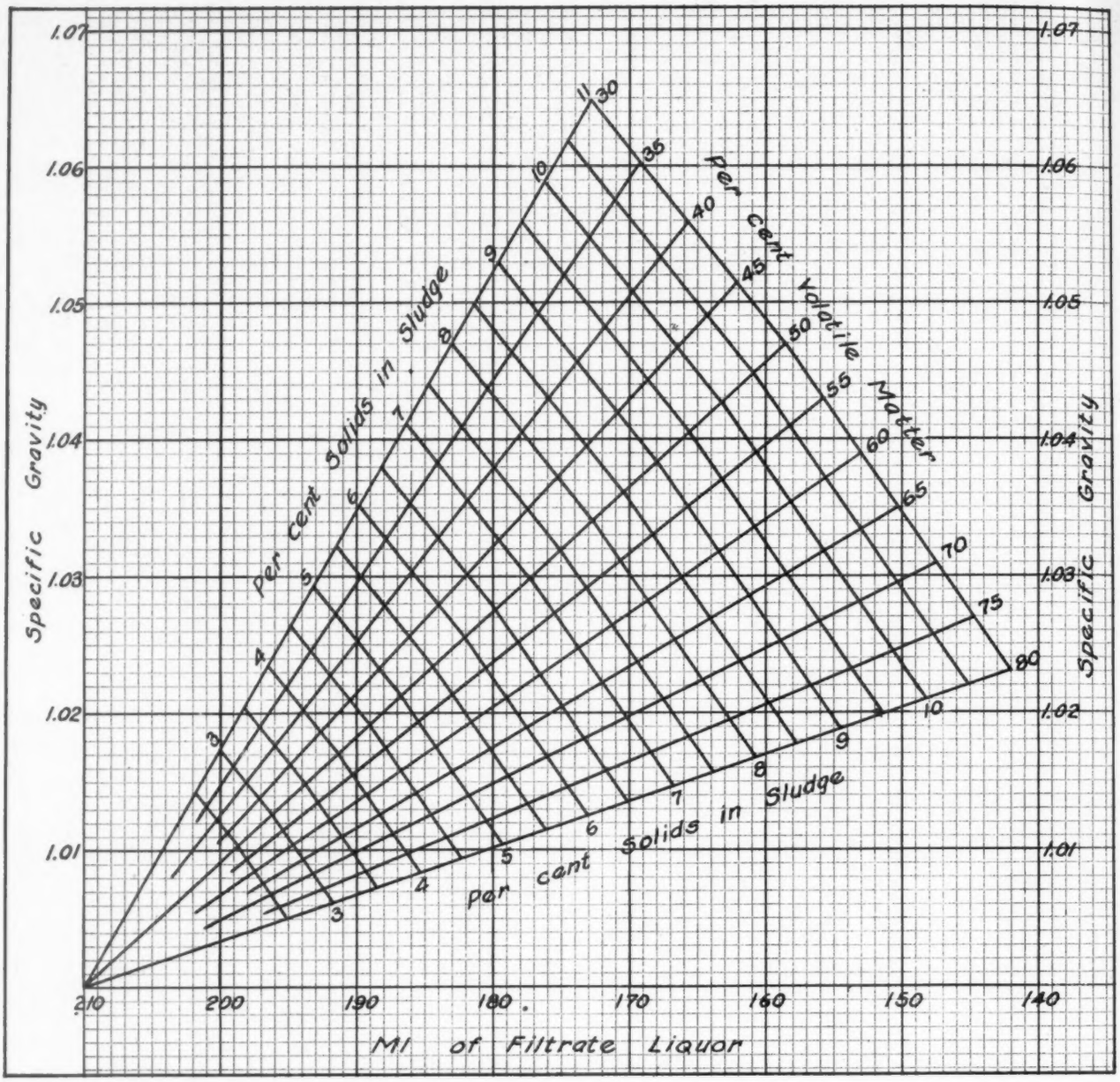


Fig. 2.—The Sludge Triangle
A Graph of Interrelations of Three Sludge Characteristics.

of the test, determine the specific gravity in a 200 ml. Erlenmeyer flask and use the sample thus weighed as the sample to be chemically conditioned and filtered. The gain in accuracy of determining the amount of sample filtered would offset the decrease in accuracy of the specific gravity determination on the smaller sample. (If the 200 ml. flask does not hold exactly that volume, the graph must be reconstructed.)

(5) If the volatile content of the sludge is not known, determine the specific gravity of the sludge and the volume of the filtrate liquor. From these, the per cent solids in the original sludge sample and the per cent volatile matter in the sludge may be determined from the graph. If the volatile content of the sludge is known, or approximately known, it may be unessential to determine the specific gravity in order to obtain the approximate concentration of solids in the sludge.

A Thorough Study Desired

This particular "Sludge Triangle" was developed on raw and digested sludge from the Buffalo sewage treatment plant. Sludges from other sewage disposal plants may exhibit different characteristics in this test and this "Sludge Triangle" therefore may not apply directly. A specific triangle may have to be developed for each particular type of sludge; this may be especially true for activated sludge. It is hoped that the applicability of this test will receive considerable study in other sewage treatment works, and that its use will be as advantageous elsewhere as it has been in Buffalo.

References

1. G. E. Symons and S. R. Kin, "The Sludge Triangle," WATER WORKS AND SEWERAGE, **89**, 17-23 (1942).
2. Standard Methods for Examination of Water and Sewage, 8th Ed., 1936.
3. G. E. Symons and B. Morey, "The Effect of Drying Time on the Determination of Solids in Sewage and Sewage Sludges," Sew. Wks. J., **13**, 936-39 (1941).
4. J. I. Smith, "Investigation of Rapid Methods for Sludge Solids Estimation," Sew. Wks. J., **6**, 908-19 (1934).

MICHIGAN SEWAGE WORKS ASSOCIATION*

Holds 17th Annual Conference

THE 17th Annual Conference of the Michigan Sewage Works Association was held in the Union Building on the campus of Michigan State College, East Lansing, on March 25, 26 and 27. Arthur B. Morrill, President of the Association and former superintendent of the Detroit sewage treatment plant, did not preside at the meeting. Shortly after his election as President of the Association, Mr. Morrill was recalled by the U. S. Army for active duty in China in the Fall of 1941. Because of previous experience in China and Burma, and because of his ability to speak the language, Mr. Morrill is a valuable man in this service. When last heard from, he was located "somewhere on the Burma road." The Conference expressed a sincere wish for his present and future welfare.

Presidents

(L.) ARTHUR B. MORRILL

Absentee president on duty in the Far East; last heard from "somewhere" on the Burma Road. Mr. Morrill left the position of Sup't of Detroit's Treatment Works to serve.

(R.) GEORGE F. WYLLIE

Sup't of Treatment Wks., Lansing, Mich. (The New President)

Sewage Works Operators School

On the three days prior to the Association meeting a short school was operated by the College for Michigan Sewage Plant Operators. The school was attended by about 50 operators. Laboratory courses were given in chemistry, bacteriology and microscopy. Lectures on plant design, hydraulics and operation were interspersed among the laboratory courses. Outstanding among the lectures were "Sedimentation" by Dr. Fischer of the Dorr Company and "High-rate Filtration" by Mr. Oeming of the Michigan Stream Control Commission.

The Conference

The Conference was called to order at 1:30 p. m., March 25, by Vice President L. R. Jennings, Sup't of the Owosso treatment plant. The Association was welcomed to the college campus by Mr. K. H. McDonel, Secretary of the college. This address was followed by technical papers by Dr. W. L. Mallmann, Associate Professor of Bacteriology at Michigan State College, Dr. A. J. Fischer of the Dorr Co. and Mr. Paul Stegeman, Sup't of the Midland treatment plant. The evening meeting consisted of a smoker and supper.

On Thursday morning the "Operators' Breakfast" was followed by a Roundtable on the subjects of "Sampling" and "Sludge Digestion." These discussions were led by A. B. Cameron, Superintendent at Jackson, and N. G. Damoose, City Engineer of Battle Creek.

At the business meeting the following officers were elected:

President—George Wyllie, Sup't of Lansing Treatment Plant.

Vice-Pres. — Clarence Stielstra, Operator, Dow Chemical Co. Treatment Plant, Midland.

Secretary — R. J. Smith, Ass't Engr., Michigan Department of Health, Lansing.

Representative on the Federation of Control—N. G. Damoose, Battle Creek, Mich.

At the afternoon session, technical papers were presented by A. T. Kunze, Sup't of Sewerage, Wyandotte, Mich.; E. B. Mallory, Lancaster Iron Works Research Laboratories, Hackensack, N. J., and H. P. Jones, Consulting Engineer, Toledo, Ohio.

Damoose Banquet Speaker

The speaker at the banquet was N. G. Damoose, City Engineer of Battle Creek, and former Sup't of the Battle Creek Treatment Plant. His subject was, "What Democracy Means to Me." This address was a masterpiece of oratory and was delivered in a manner which stirred the emotions of all present. It contains a message to which every American should subscribe. [Mr. Damoose's address will be printed in full in our next issue.—Ed.]

Friday morning sessions were given to the the presentation of papers by W. E. Smith and A. E. Griffin of Wallace and Tiernan Co., and M. P. Adams, Michigan Stream Control Commission.

Technical Papers

Dr. Mallmann spoke on "Decontamination" from the viewpoint of the prevention of the spread of disease producing bacteria. This paper related more especially to the activities and recommendations of Sanitary Wardens during war time.

Dr. Fischer's paper on "The Present Status of Biofiltration" presented much up-to-date information on this process that has hitherto not been published. At present there are 107 biofiltration plants in operation or under construction, 62 of which are in connection with defense works. Various types of flow sheets were shown and discussed. B.O.D. removal of 17.3 pounds per K.W.H. were reported. Two-stage biofilters were compared with activated sludge. Single stage filters average 60 to 65 per cent removal and 2-stage 85 per cent or better.

Officers

(L.) *Rob't J. Smith, Asst. Engr. Mich. State Dept. of Health, Lansing (Secretary and Treasurer)*

(R.) *Clarence Stielstra, Chief Operator Dow Co.'s Waste Treatment Plant Midland, Mich. (New Vice-President)*

Paul Stegeman described the Midland plant. This plant produces a sludge having 25 to 30 per cent solids, which will pump readily and may be dried on a vacuum filter to

*A special report for WATER WORKS AND SEWERAGE, by E. F. Eldridge, Associate Engineer, Michigan Engineering Experimental Station, and author of "Industrial Waste Treatment Practices."

55 per cent moisture. The unusual character of this sludge is due to the infiltration of a type of clay in large amounts into the system. Midland's garbage is ground and discharged with water into a "classifying" pit or well. The upper portions of the garbage slurry are pumped to the digester direct, while the lower portion, containing eggshells, bones, bottle caps, grit, etc., discharges to the detritor. This eliminates the reported difficulties caused by such materials in digester units and equipment.

Programmers

(L.) N. G. DAMOOSE
City Engineer, Battle Creek, Mich.
(His after-dinner "What Democracy Means to Me" was stirringly delivered.)

(R.) PAUL STEGEMAN
Sup't Water and Sewerage, Midland, Mich.
(Because of his tall story about sludge density and pumping—they now call him Paul Bunyan Stegeman.)

Al Kunze discussed the sewage treatment facilities of Wayne County. These facilities consist of small primary treatment units located in the various districts suorrounding the city of Detroit. Sludge from these units is hauled to the Wyandotte plant where it is dewatered by vacumm filters and incinerated.

E. B. Mallory discussed the control of the activated sludge process through observations of variations in sludge characteristics and adjustment of return sludge ratios to maintain a "sludge oxidation index" within prescribed mathematical limits. This constituted the first of a series of papers each of which dealt with a specific factor in the control procedure. The development of the important sludge "Oxidation Index" and its practical application was presented in detail and its significance was compared with the usual "Sludge Index" now in use. Sludge settling characteristics and ability of the process to absorb shock loadings was shown to be a function of the degree of sludge oxidation. "Bulking is man-made" and indicates a deviation from the optimum condition. Each plant has a rather definite optimum "Sludge Oxidation Index" which is determined by plant characteristics. This optimum condition and its determination was discussed. [Mr. Mallory's paper is to be printed in full in an early issue of WATER WORKS AND SEWERAGE.]

Harvey Jones discussed "Problems of the Consulting Engineer." The present war program has almost entirely elimnated municipal treatment plant construction. During this period the chief problem is to get maximum results from the existing equipment. Mr. Jones pointed out that political and financial considerations continue to influence the engineer's design.

Walter Smith discussed the important factors in "Chlorinator Maintenance," while A. E. Griffin discussed "Chlorine Residuals in Sewage-High-Low-Sub." The following major neglects in chlorination practice were stressed: (1) Care of major valve from cylinders. (2) Maintenance of stuffing box on pressure reducing valve. (3) Cleaning of water strainers. (4) Prevention of chlorine-hydrate (chlorine ice) formation in bell-jar and pressure valve at temperatures of 46° F. and lower. Chlorine cylinders should *always* be kept at temperature below that of the control apparatus in order to prevent troubles due to re-liquifaction of the gaseous chlorine in the feed lines and chlorinators.

Milton P. Adams' paper dealt with "Pollution and Priorities." The main point of the discussion was a recent court ruling having to do with the discharge of storm water containing small amounts of sanitary sewage. The court decision was to the effect that storm water may be rightly diverted into normal water courses untreated, but when this storm water contains sewage the right no longer exists no matter how small the proportion of sewage. The obligation of a municipality to treat sewage does not end with rainfall. Therefore, said Mr. Adams, any diversion of excess storm overflows from combined systems in order to relieve the treatment plant is unlawful in Michigan.

Programmers

(L.) DR. A. J. FISCHER
Development Engr., The Dorr Co. New York City

(R.) WALTER E. SMITH
District Mgr., Wallace & Tiernan Co. Detroit

Dr. Arthur Talbot Dies

Dr. Arthur Newell Talbot, professor emeritus of engineering at the University of Illinois, passed away on April 3rd after a brief illness. He was 85 years old.

Dr. Talbot, revered by his numerous students and beloved by many, became renowned as a research leader and teacher. With several important developments to his credit, he retired from regular teaching in 1936, but combined his research and professional society activities up to his last illness.

Dr. Talbot was born in Cortland, Ill., in 1857 and was graduated by the University of Ill. in 1881. He returned to his *alma mater* in 1885 to accept a teaching position and in 1890 was made full professor of municipal and sanitary engineering. The success of his career since was amply attested when in 1938 the University of Illinois acclaimed him by changing the name of its famed materials testing laboratories to the "Arthur Newell Talbot Laboratory."

In 1903 when reinforced concrete was only just beginning to be recognized as a structural material, Dr. Talbot began experimental work in this field which soon placed him amongst the leaders in this new development. For many years he represented the Am. Soc. of Civil Engineers on the Joint Committee on Reinforced Concrete. Dr. Talbot also developed the well known Talbot formulas for determining maximum rates of rainfall and for fixing the areas of waterways. He also developed the widely used "Talbot Spiral" employed in designing railroad curves and headed a Am. Railway Engrs. Assn. committee on truck stresses for 29 years.

Dr. Talbot had been honored by being elected to honorary membership in practically every scientific or professional society in which he took an active part. He served as president of the Am. Soc. of Civil Engineers (1918) and of the Am. Soc. of Testing Materials in 1913. He was the recipient of many medals and awards, the most distinguished being the John Fritz Medal, the highest award in the engineering field, which Dr. Talbot received in 1937.

WHEN THE FIRST RAILROAD across the nation was completed, a golden spike was driven in the last tie that joined this great ribbon of steel between the East and the West. The vision, firm purpose, and hard work that finally achieved this great union, marked an epoch in transportation that was symbolized forever in that one golden spike.

THE GOLDEN SPIKE THAT SEALED A GREATER SERVICE...

FROM THE PAINTING, "DRIVING THE LAST SPIKE," BY THOMAS HILL. REPRODUCED BY COURTESY OF M. H. DE YOUNG MEMORIAL MUSEUM, SAN FRANCISCO

The joining of the Niagara Alkali Company and the Electro Bleaching Gas Company is likewise an historic completion of a great service... in the fields of chemical research and manufacture. The "golden spike" that symbolizes this union is the reputation and integrity painstakingly maintained by each of these two companies that now become one... the Niagara Alkali Company... united in enterprise and resources to better serve man and his industries.

Niagara
ALKALI COMPANY
60 EAST 42nd STREET, NEW YORK, N. Y.

CAUSTIC POTASH · CAUSTIC SODA
PARA · CARBONATE OF POTASH
Liquid Chlorine

EBG NIAGARA ALKALI COMPANY

SAND REMOVAL FROM WELL WATER

Some Notes on the Use of Brassert Automatic Self-Cleaning Strainers at Houston, Texas

By G. L. FUGATE
Chief Engineer*
WATER DEPARTMENT
HOUSTON, TEXAS

THE acquifers of the ground source of water supply in the West Gulf Coastal Plain, in which Houston is located, are composed of unconsolidated sands. At Houston some of these sands are of such size that 95 per cent is retained on a 150 mesh screen and the remaining 5 per cent is retained on a 200 mesh screen. The best constructed wells will produce some sand, and more when operated intermittently.

Many of these fines in the 5 per cent retained on the 200 mesh are conical shaped. They settle slowly and the velocity through the relatively small suction storage tanks is often too high to permit their removal by sedimentation. As a result, they are transmitted into the distribution system. This in turn causes customers to complain and creates troublesome and expensive meter maintenance and possible loss of revenue because of clogged or damaged meters.

Such conditions brought about studies to determine how the fines might be removed by means of mechanical equipment. These studies led finally to installing two Automtaic Mechanical Strainers, manufactured by H. A. Brassert & Co., of Chicago. One installation was made at the Scott Street Plant and one at the South End Plant.

It is believed that the installation of these strainers here at Houston in the Fall of 1939 represents the first application of these industrial water supply strainers for the interception and removal of fine sand from a public water supply. We understand that more recently an installation of the same sort has been made in El Paso, Texas. There are possibly others also by this time. With Houston, however, the scheme appeared to be sound but the installation was made on an experimental basis.

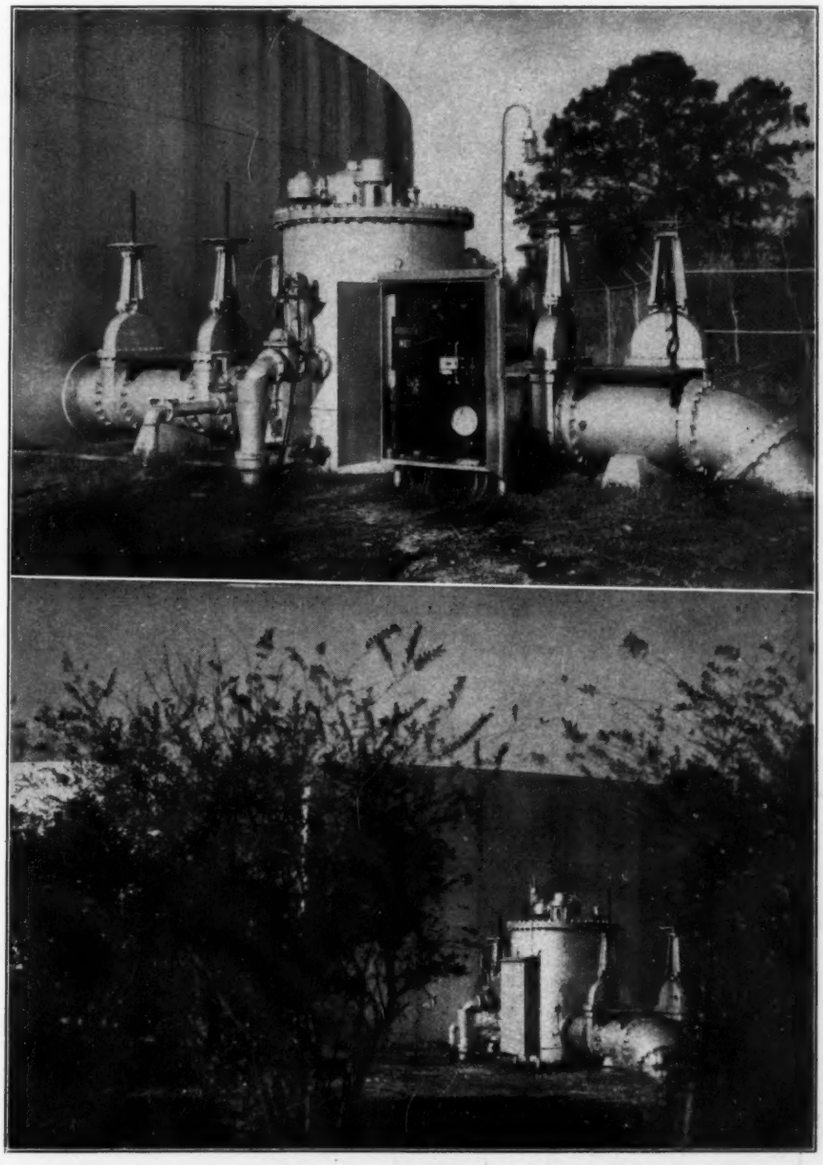
The Brassert Strainers

Construction details of these automatic self-cleaning mechanical strainers are shown in Fig. 1, a drawing supplied by the manufacturer.

*The contributor of this article has the distinction of being Chairman of AWWA's Plant Management and Operating Division. —Ed.

The Author*

Briefly described, the Brassert strainer consists essentially of a rotating cone-shaped drum, fixed to a vertical shaft, centered within a cast iron housing. The entire vertical surface of this drum is drilled with rows of holes into which are inserted the screening media. A washout orifice, in the form of an internal vertical slot cast integrally with the housing, is machined and lapped into the contour of the drum to engage



Two Views of the Automatic Sand Strainers at Houston, Texas.

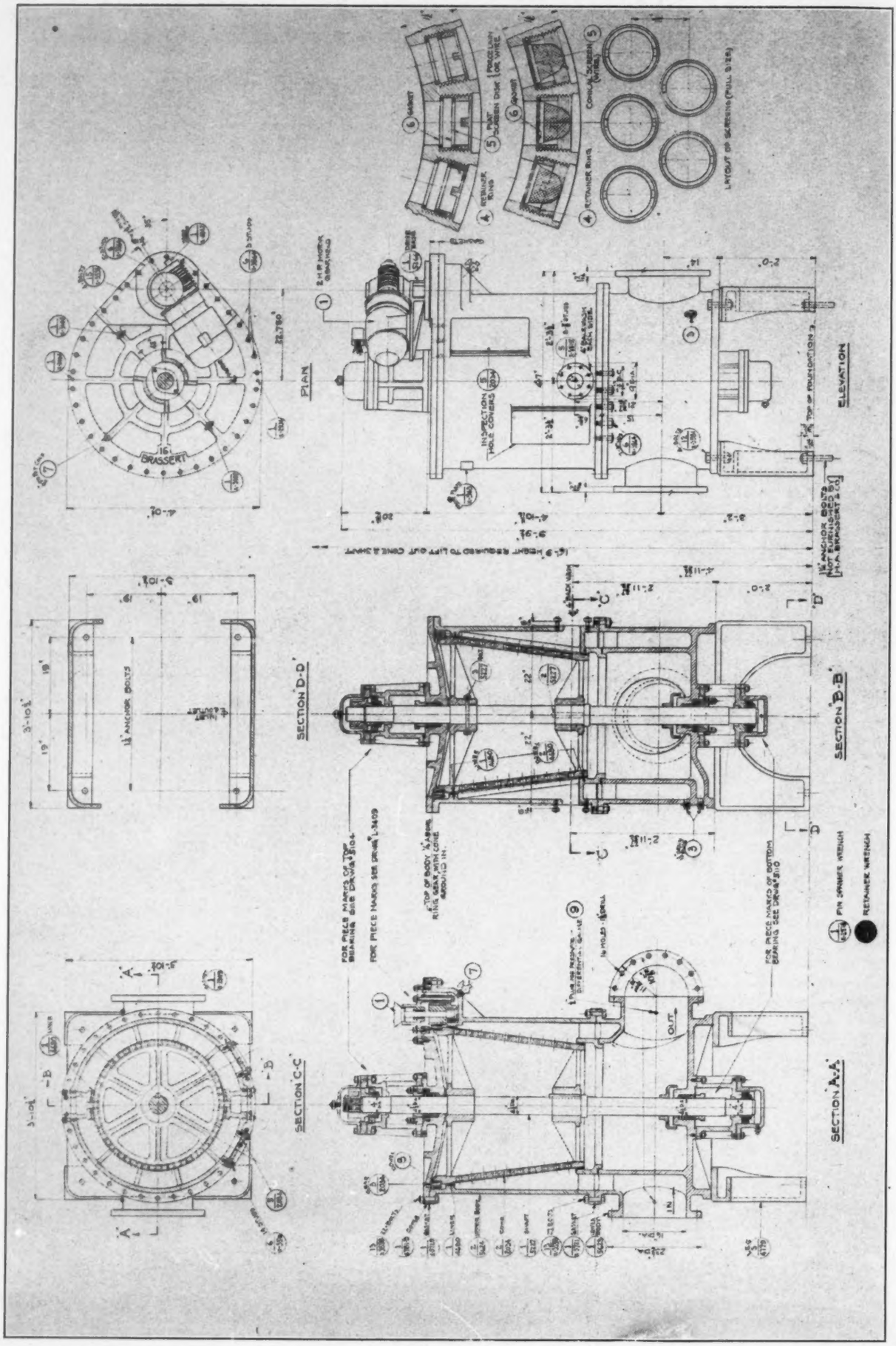
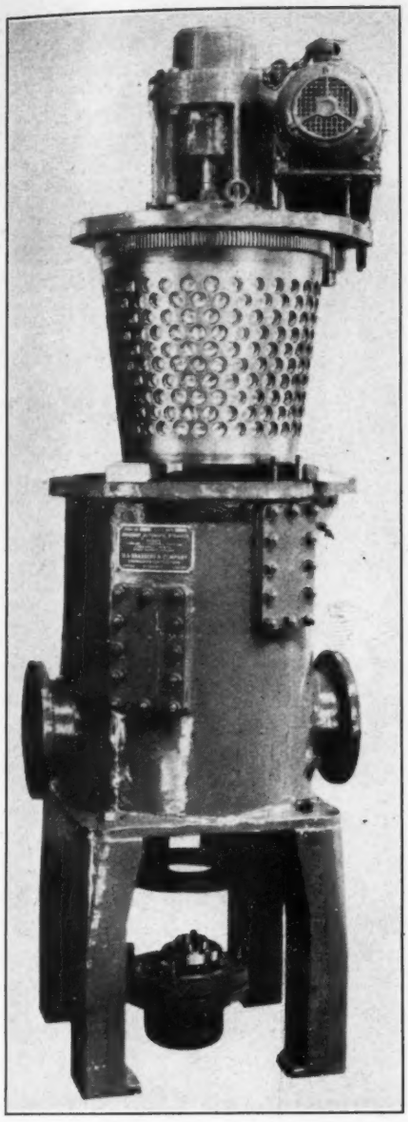


Fig. 1.—Manufacturer's Drawing of the Brassert Automatic Strainer



A Brassert Strainer

Showing the screen studded revolving cone. Houston strainers have 2,528 of these screens.

one vertical row of holes on the drum as it rotates.

Water enters through an inlet at the bottom of the housing, then, rising around the revolving drum, passes through the screening media and into the drum. In the process, sand or other matter to be strained is accumulated on the screening discs and carried by the continuous rotation of the drum to the washout slot, where it is flushed out by a reverse flow of clean water from inside the drum. The discharge of clean water is effected through an outlet at the bottom of the housing, opposite the inlet.

The drawing (Fig. 1) used with this description is of a smaller sized unit than the 24-inch units installed in Houston—the substitution of the drawing being a result of the fact that the small lettering on the drawing of the Houston units, and greater amount of detail, is not subject to as satisfactory reproduction in magazine page size. Even so, some of the unimportant details may not be readable without use of a magnifying glass.

The 24-inch units installed in Houston weigh approximately 19,000 pounds each, have an overall height of a little better than 108 inches, and measure 76 inches from inlet to outlet flanges. The strainer drum contains 2,528 screening discs of 200 mesh stainless steel screen. The drum is rotated by a 5 hp. 220-volt motor.

The method of installing and location of these units is revealed in the sketch designated Figure 2.

Operating Experiences

When these strainers were put into operation they clogged rapidly. Under the microscope the conical shaped sands, mentioned before, could be seen wedged in the screen openings and the automatic low pressure back-wash was insufficient to effectively dislodge them. A connection was made to the distribution side of the high lift pumps so that high pressure and a relatively large volume of back-wash water could also be used as required at intervals and for short periods of time. This method proved effective and the frequen-

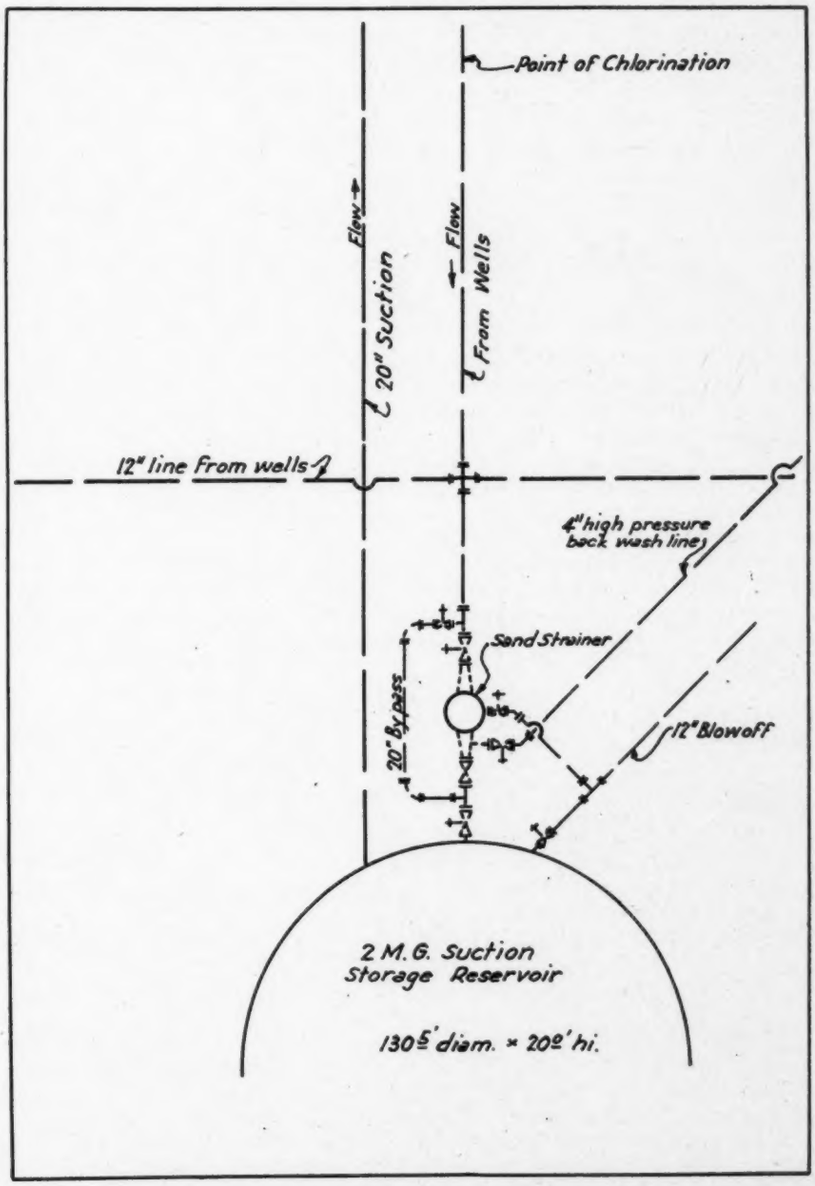


Fig. 2.—Installation Diagram and Flow Sheet.

Reveals location of strainers in relation to wells, suction storage reservoirs, and high lift pumps delivering to distribution system.

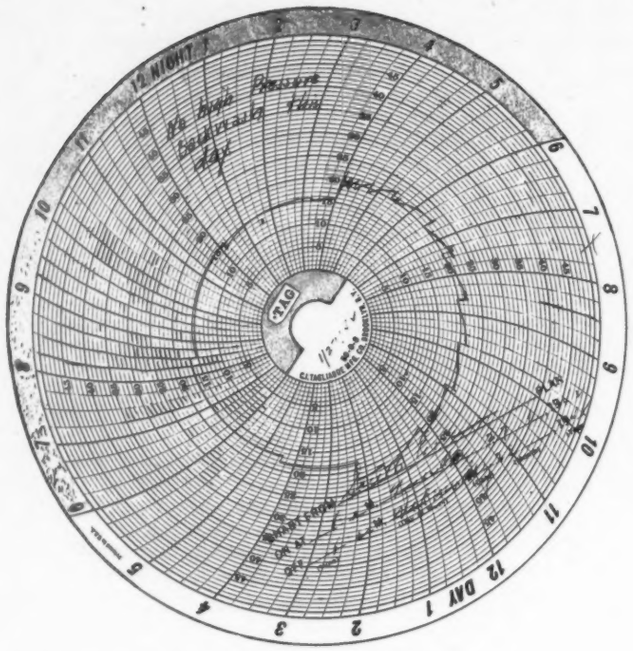


Fig. 3—Operating Chart for South End Plant.

(Note that no high-pressure washes were required during this operating period. Where the pen drops back indicates the automatic low pressure washes, their frequency depending upon pumping rates and quantity of sand being delivered by the wells.)

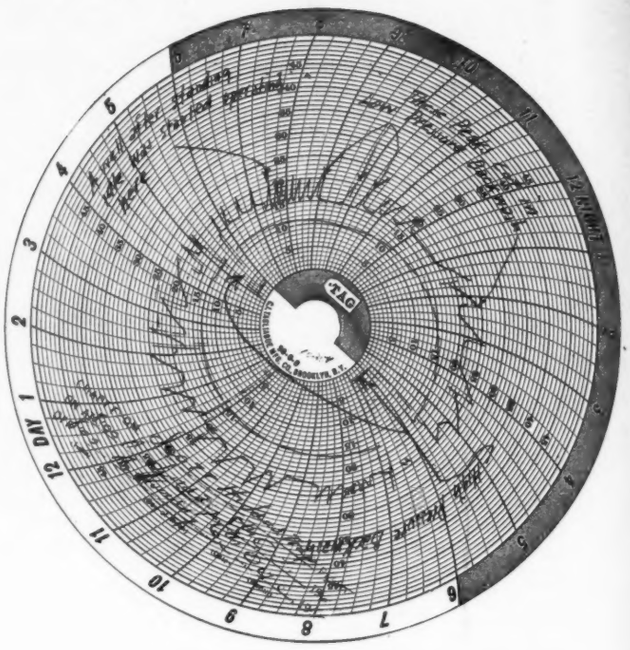


Fig. 4—Operating Chart for Scott Street Plant.

(The saw tooth pattern of the pen line indicates frequency of the automatic low pressure back-wash. Note the effect between 7:30 and 9:00 A.M. from the cutting in of a well which had been out of service for a time. The two high-pressure back-washes are indicated by the pen drop at 5:30 A. M. and 5:10 P. M.)

cy of high pressure back-washing varies with the quantity of sand in the water. The strainer units must be valved off from service during the high pressure washing, and this procedure, without power operated valves, proved more or less laborious. The State Health Authorities ruled that the high pressure back-wash line was a cross connection between treated and untreated water and its use for a time was abandoned and the strainers not operated. This objection has now been eliminated.

Pre-Chlorination Solves Two Problems

As the result of a gelatinous, non-pathogenic organism found growing in the wells, the chlorination of the water before it entered the suction storage tanks was begun, to assist in taste and odor control. A residual of about 1.4 ppm. is now being maintained in the tanks and this eliminates the cross-connection objection. The strainer at the South End Plant has been put back into service and it is found that since the pre-chlorination was begun, the clogging of the screens is less. The reason for this is that the gelatinous material enveloping the sand grains is, by chlorination, broken away, leaving the grain clean. It is also noted at the other plants, where sedimentation only is depended upon for sand removal, that the removal there is also improved by pre-chlorination.

Washing Economy Improved

To conserve wash water, the drain from the screen chamber has been equipped with an automatic valve. When the pressure has increased to a predetermined value, due to the clogging of the screen, the differential of pressure between the feed and the drain sides operates an electric motor control so that the valve is opened and the screens are back-washed automatically by low pressure. A time relay on the control holds the valve open for one entire revolution of the screen drum. This scheme was substituted for the continuous back-wash. The quantity of wash water has been reduced about 75 per cent in this manner. Operating charts on the strainers are reproduced as Figs. 3 and 4.

Conclusion.

The strainers definitely remove the sand and the cost of their installation and operation is fully justified. Like any other pioneering installation, there were "bugs" to be removed, and experience has taught us how to iron these out one after another.

Operating Costs

Operating Cost of Brassert Strainer Based on 1941 Pumpage, South End Plant, Houston, Texas.

Increased head on well pump with power at 6 mills per KWH.	$225.00
5 horsepower to operate strainers	196.00
Amortization and interest at 6%	360.00
No extra labor employed.	
Per annum	$781.00
Per million gallons	0.48

THE NEW LAKE ERIE WATER SUPPLY SYSTEM OF TOLEDO

A Dream That Has Come True After 72 Years

By FRANKLIN R. HAWKINS*
TOLEDO, OHIO

THE date of January 12, 1942, was an historic one in the life of Toledo, Ohio. On that day, residents of the city had their first taste of Lake Erie water from faucets. Since it was Monday, housewives had an opportunity to do the family wash with lake water shown by tests to be 60 per cent softer than the Maumee River water which had previously been utilized.

January 12, 1942, was 72 years after Lake Erie was first considered as the desirable source for Toledo's water supply. After being repeatedly tabled during that span of years because of expense, the project got under way in the autumn of 1938 following approval by voters. The four main reasons for taking water from the lake instead of continuing to use that from the scenic Maumee River which starts in Ft. Wayne, Ind., and winds north and east and up through Toledo, are:

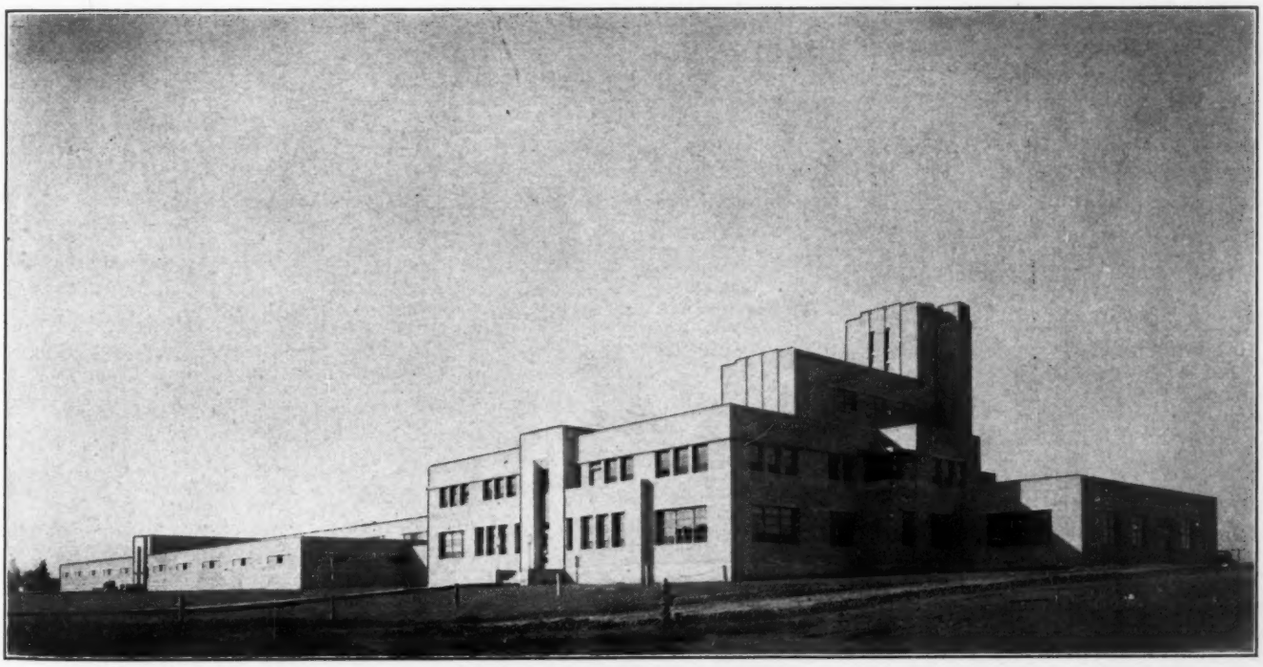
1. Water from the lake is on the average less than one-half as hard as that from the river.
2. Lake Erie water is of more uniform quality, therefore more easily treated.
3. The lake has one-fiftieth the pollution of the river.
4. The city's water supply from the river was jeopardized whenever a high wind lowered the level of the lake and reduced the flow at the Maumee intake.

A critical situation arose on December 28, 1939, a year after work had begun on the Lake Erie project, which fully demonstrated the inadequacy of the city's river water supply. On that day, Toledo was within ten minutes of a shutdown of its entire water supply. For 13 hours Toledo was at the mercy of a high wind which lowered the level of Lake Erie and reduced the flow of water at the intake to almost zero. The river became a stream four feet wide and barely two feet deep. Pressure on the distribution system dropped from 75 to 15 pounds. Fire during that period in all probability would have wiped out Toledo.

New System Will Pay For Itself

The Lake System was completed the latter part of 1941 at a cost of $9,884,463, with the city paying 55 per cent of the expense through revenue and general obligation bonds, and the balance was paid through the Federal Public Works Administration. The project will liquidate itself. Bonds against it represent no

*Libbey, Owens, Ford Glass Co.



Toledo's New Filtration Plant.
Largest Unit in the $9,884,463 *Lake Erie Water Supply Project, Placed in Operation January* 12, 1942

tax increase as they will be paid out of revenues from the 70,000 consumers in the Toledo water district. The largest consumer pays a water bill of $108,000 a year, while many small ones pay but 60 cents a month.

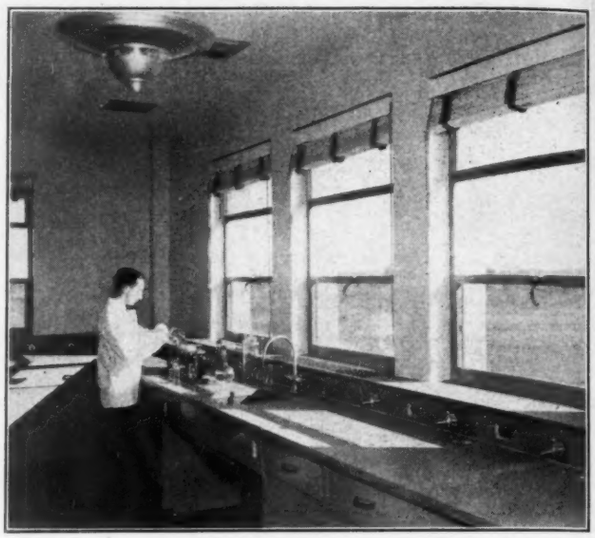
Although the system will serve only 325,000 people at present, it was constructed to take care of a city of 750,000. The intake crib, two miles out in the lake, and supply conduit are capable of providing an adequate volume of water for Toledoans in the year 2000.

Five thousand men, representing about 900 trades and professions, helped build the lake supply system without the loss of a life. Begun with a plentiful supply of materials and labor, the project was finished under the pressure of defense manufacture. Despite difficulties, construction moved forward at a hundred different locations on a 15-mile front; under two mayors, two city managers, changing councilmen, revolutionary economic conditions, in peace and war.

Eight Sections in New Waterworks

Listed chronologically there are eight elements in Toledo's new water supply system, as follows:

1. Intake crib and conduit two miles offshore.
2. Low service pumping station.
3. Lake Erie supply pipe line.
4. Filter plant.
5. Covered 35-million gallon filtered water reservoir.
6. High service pumping station.
7. One million gallon elevated reserve water tank.



A Corner of the Laboratory.
An interesting feature is the use of heat absorbing plate glass for southern and western windows. This glass filters out 50% of the sun's infra-red rays, and has been used also for office windows in the plant.

Filter Operating Floor of Toledo's New 80 M.G.D. Plant.
With ten 4 M.G.D. units to a side, this gallery is longer than a football field.

8. Trunk main running in a general westerly direction across the city.

Crib Walls 20 Feet Thick

The intake crib, located in waters shown by tests to have little bacterial pollution, is circular. It measures 100 feet in diameter at the bottom and 83 feet across at a point 3½ feet above the mean lake level. It was built within a cofferdam consisting of 16 cylinders, each 30½ feet in diameter, and two closure cells formed of interlocking steel sheet piling driven to a point 18 feet below the bed of the lake.

After the crib was completed, the cylinders of the cofferdam adjacent to the concrete substructure were sheared off at lake bottom. Walls of the crib are reinforced concrete 20 feet thick at the base. Sixteen ports, each ten feet square, through the lower portion of the structure admit water into a central well 60 feet in diameter. Near the well's bottom is an outlet of 12-foot diameter from which the intake conduit spans 15,500 feet to the low pumping station on the shore.

Powered by electrically driven centrifugal pumps, the station has a capacity of 150 million gallons of water daily. Its job is lifting water from the level of the lake to the level of the filtration plant floor nine miles away. The steel pipe through which the water is forced is 78 inches in diameter and buried under marshlands and woods.

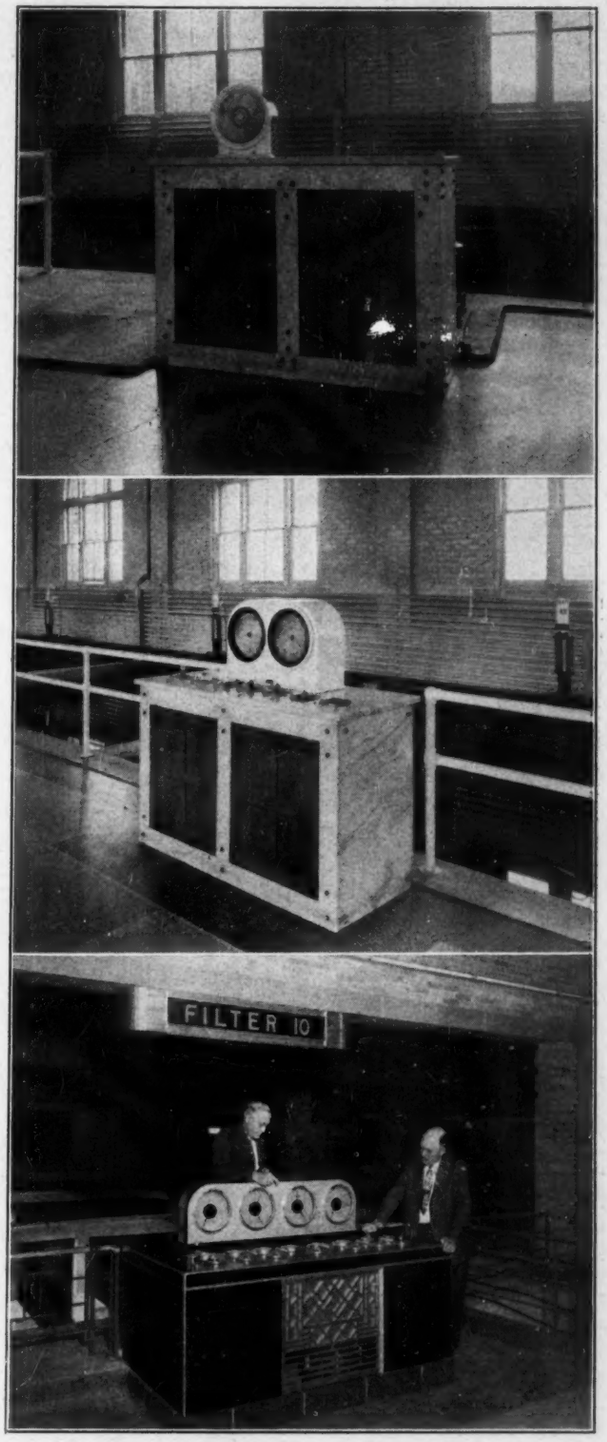
In the chemical building, the water is treated with lime, alum and activated carbon prior to filtration. Because of the high quality of the lake water less than one-third of the chemicals needed for the river water will be required. Accurate and up-to-date feeding equipment of the latest type is used to assure the most effective and economical operation. Chemicals are purchased in bulk, unloaded with pneumatic equipment and stored in hoppers at the top of the structure. The design of the building and reaction and settling basins is such that softening can be applied if a softer water is desired in the future.

Heat Absorbing Glass in Laboratory and Offices

The comfort of the laboratory personnel and office workers in the chemical building was considered. Libbey-Owens-Ford Heat Absorbing plate glass was used to glaze the windows in these spaces which in the main face south. This special plate glass has the unique ability of removing approximately 50 per cent of the solar heat from the sunlight passing through the windows. Since the laboratory counter and sinks are in front of the row of windows, the chemists will be protected from the beating infra-red rays of the sun while they work. Their vision will not be restricted as this unique heat absorbing glass is clear.

The Filtration Plant

Twenty filters, each of which has a daily capacity of four million gallons are on each side of the main gallery of the filtration plant. The water passes down through 30 inches of specially selected silica sand and 18 inches of graded gravel. After filtration, liquid chlorine is applied for disinfection and the "cleaned" water goes to the underground 35 million gallon storage reservoir from which it is pumped into the distribution system against 75 pounds of pressure.



Three Decades of Filter Tables.

Here is pictured three decades of progress in filter operating tables at Toledo. At the top is one of the 20 tables installed in 1910 in the first filtration plant. Ten years later, 22 tables like the one pictured in the center were added to the enlarged plant. In the lower view, Robert W. Furman, Water Commissioner, and City Manager George N. Schoonmaker are looking over one of the 20 control tables made of "Glastone" installed in the new filtration building.

Control Tables Made of Glass

At the end of each filter and standing like sentinels on either side of the main gallery are the filter control tables. These tables are as sleek, streamlined and modern as the rest of the huge filtration plant. Because they are made of black "Glastone" (a masonry unit faced with gleaming Vitrolite structural glass manufactured by Libbey-Owens-Ford) the control tables can be kept in a scintillating condition by wiping with a damp cloth. It marks the first use of "Glastone" for anything of this nature.

More than 5,000 square feet of this new glass-faced, load-bearing structural unit were used in the three waterworks buildings. In addition to being employed for the control tables, "Glastone" frames the entrances and forms the walls for vestibules, stairways and lobbies. In the chemical wing of the filtration plant there is a map of the whole Lake Erie Water Supply System. This novel map, which attracts every visitor, is sandblasted in the cadet blue Glastone and painted.

It is fitting that the new water plant of Toledo—called the glass center of the world—contains such quantities of modern glass. Approximately 20,000 square feet of various types of Libbey-Owens-Ford flat glass were installed. Besides Glastone and heat-absorbing plate, satinol Flutex patterned glass was used over fluorescent lighting tubes, colorful "Vitrolite" structural glass panels the walls of lavatories, and wire glass was employed for obscure glazing.

Briefly summarized, the new Lake Erie Water Supply System for Toledo is a substitution of supply works, main pipes, chemical treatment, filter and storage for the old system. Only the old distribution mains of the old water system were retained.

Treatment of Entrances

All entrances are bordered with the same easily maintained "Glastone" in the pleasing cadet blue shade suggestive of pure water.

Architectural Beauty.

Has been achieved in Toledo's Filtration Plant. In this instance a satin polished hand-rail stands out against gleaming walls of "Glastone" structural glass of cadet blue. To keep these walls clean and sparkling only a damp cloth is required.

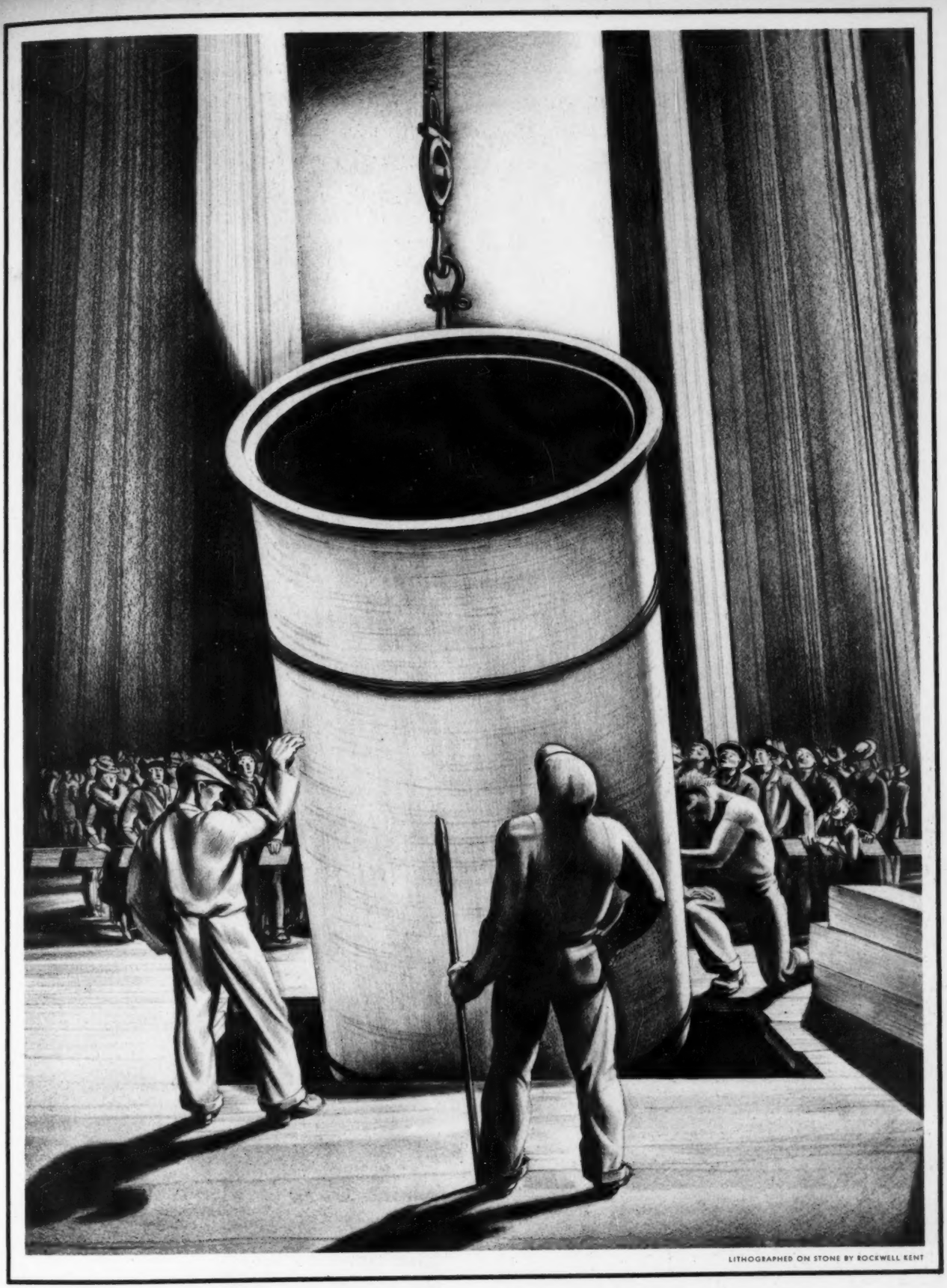
It has been figured out by a statistician that water from the new lake source will cost three cents a ton delivered to the faucets. Broken down, this is supposed to represent a charge of approximately a half-cent per person a day.

Softer Water Will Save $600,000

Householders of the city will save approximately $600,000 a year, or $1.85 per person, on soap and softeners, it is estimated. The city will spend $36,000 annually to chemically purify the lake water in contrast to $105,000 which has been spent on the Maumee River's supply.

Other savings are numerous. Cost of fire protection, due to the great volume of the lake supply, is an important factor. For industries, the extra cost of incrustation in pipes and boilers, due to the hardness of the river water, will be dissipated. The wear and tear on garments will be lessened to the point where every family member is expected to notice the longer life of his clothes.

All the work on the project was carried on under the direction of George N. Schoonmaker, city manager and chief waterworks engineer. Robert W. Furman, water commissioner, was in close touch with the design of the filtration plant and the development of the project, and William G. Clark, acting as supervising construction engineer, was in charge of the project. Mills, Rhines, Bellman & Nordhoff, Inc., of Toledo, were consulting engineers with Greeley & Hansen, Chicago, who prepared the plans and specifications.



LITHOGRAPHED ON STONE BY ROCKWELL KENT

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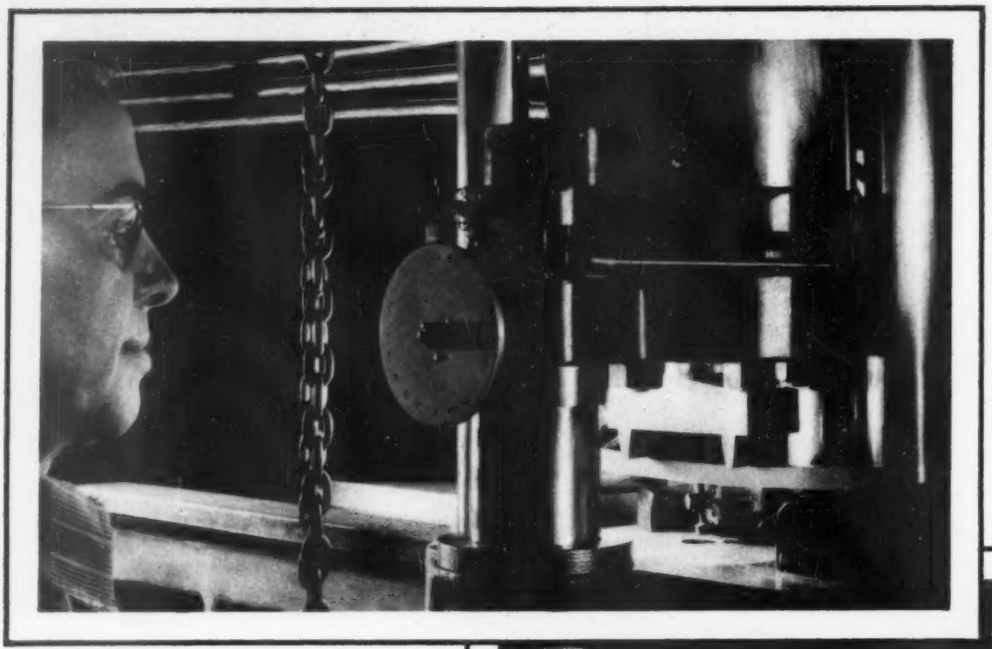

* The "Talbot Strip Test," illustrated above, is an acceptance test for cast iron pipe. The modulus of rupture and secant modulus of elasticity are determined from this test, made on a strip cut from the wall of a pipe. It is one of the routine tests made by this Company to insure that the quality of its pipe meets or exceeds the requirements of accepted standard specifications for cast iron pipe.

*** One of a series of controls in operation at each of our plants, beginning with inspection and analysis of raw materials and ending with tests of the finished product, all subject to the central control of our headquarters staff at Burlington.**

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PIPE

Centrifugally or Pit Cast for water, gas, sewerage, drainage and industrial services.

SPECIAL DEFENSE SESSION OF THE NEW JERSEY SECTION

In Which Utility Preparedness and Management Cooperation Were Featured Topics

By HARRY A. FABER*
Associate Editor

AMPLY demonstrating that water works men are awake to the need for every bit of procurable knowledge concerning water utility preparedness and wartime protection, a new attendance record was set when 168 members and guests crowded the spring meeting of the New Jersey A.W.W.A. section.

To Trenton, on March 26th, came the superintendents and officials of large, small, and medium sized water utilities. They came from all parts of Jersey and even from New York and Pennsylvania. They came with the sincere desire to obtain timely information which would enable them to do the best possible job in their communities — to keep water flowing, come what may.

Honored
J. Arthur Carr, Superintendent, Ridgewood, N. J. (Winner of the Fuller Award)

Guest Speaker
J. H. Murdoch, Jr., Counsellor, Amer. W.W. & E.Co. (Chm'n Pa. Water Sup. Defense Com.)

No time was wasted in this half-day meeting. Five technical papers were presented, committee reports were read, and there was still time for a round table discussion. P. S. Wilson, Program Committee Chairman, Secretary C. B. Tygert, and all who assisted in planning this meeting, can be proud of the result.

Fuller Award to J. Arthur Carr

Announcement was made, during the luncheon, of the member chosen to receive the Fuller Memorial Award for 1942. J. Arthur Carr, Superintendent, Ridgewood, N. J., was named by the award committee as most deserving of this honor because of his outstanding studies on the development of rock wells, and his work as co-chairman with Jas. A. Harding of A.W.W.A.'s committee on "Deep Wells and Deep Well Pumping Equipment."

The Chairman
Wm. F. Ayars, Superintendent, Salem, N. J.

Sec'y-Treas.
Cyril B. Tygert, Sales Engineer, Newark, N. J.

N. J. Defense Council Chief Speaks

Thomas Dignan, chief of staff of the New Jersey State Defense Council, was the first speaker of the afternoon. He outlined the work of the Council with relation to utilities, referring especially to integration of plans for civilian defense. This office will shortly issue a standard card providing air raid signals and instructions to apply throughout the State.

Water utilities will be represented on the Council by a State coordinator and an assistant coordinator. Comprehensive information and data on water supplies will be made available to officials in control centers but will be kept secret. Interconnection of water supplies, well advanced before Pearl Harbor, is to be extended. Supplies will be guarded by local men, and ordinary and extraordinary sanitary precautions are to be provided. A training program is underway to supply labor for utilities in periods of emergency —labor which can be directed for temporary repair jobs, and labor sufficiently trained to make permanent repairs.

Through defense central centers, all utility services will be coordinated in each municipality: water supply, police services, fire fighting equipment, and medical services will function from a central headquarters. These local centers will be further controlled through area and zone offices. Civilian cooperation is needed to make such a system function and the response to date has been most gratifying.

Program Headliners
H. E. Jordan, Exec. Secy., A.W.W.A.
and
Maj. J. H. Brewster, San. Engr., U.S.P.H.S. 1st and 2nd Regional Defense Areas Office of Civilian Defense

"Round-Table" Leaders
"Ed" Hyland, Supt. Water & Sewerage Moorestown, N. J.
"Vern" Smith, Supt. Water & Sewerage Park Ridge, N. J.

"Water Works Cooperation for War," by John H. Murdoch, Jr., (President, Pennsylvania Water Works Association, Chairman of the Pennsylvania Water Supply Defense Committee) Attorney, Am. Water Works and Electric Co., New York City.

With the theme that "Water Wins Wars," Mr. Murdock described management's responsibility to keep water flowing both for industrial and civilian needs. An entirely voluntary organization for emergency cooperation has been set up in Pennsylvania. It has no legal or governmental standing nor, to date, does any seem to be needed, emphasized Mr. Murdoch.

The immediate response to cooperate has exceeded all expectations. Everyone appears to recognize the vital need of maintaining

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

this vital service without interruption. Authorities are making every possible preparation to provide water for *all* needs, but agree to supply war industries first if a choice must be made between commercial users. It is considered a duty to have necessary repair materials available and to cooperate with all other industries.

Fifteen water districts comprise the State of Pennsylvania. Each district has a collected inventory of the water systems included, so that availability of needed materials can immediately be determined. Mr. Murdoch believes the willing attitude of everyone concerned to be typical of democratic cooperation in time of emergency. In developing similar coordinated utility organizations, only the proper direction appears to be needed.

"The Water Works System and the War," by Major John H. Brewster, Sanitary Engineer, U. S. Public Health Service, First and Second Regional Defense Areas of O. C. D.

Walter Spencer
Superintendent
Merchantville, N. J.
(Secy., South Jersey Water Supts. Assn.)

P. S. Wilson
Engr. & Consultant
Glen Ridge, N. J.
(Program Committee Chairman)

(1)
E. A. Sigworth, Sales Engr., Ind. Chemical Sales Div., W. Va. Pulp & Paper Co., N. Y. City

(2)
W. S. Hill, Supt. of Water, Clayton, N. J.

(3)
Asher Atkinson, Chemist and Engr., Water and Sewerage Depts., New Brunswick, N. J.

(4)
Richard E. Wagner, President, Zeolite Chem. Co., Medford, N. J.

(5)
H. J. ("Dutch") Helberg, Hersey Meter Co., Boston, Mass.

Major Brewster requested that his information be considered confidential and that it should not be published. (While we are sorry, we must concede this request.—Ed.)

"War Materials and Water Works Service," by Harry E. Jordan, Secretary, American Water Works Association.

The development of mutual aid systems for water works was hailed by Mr. Jordan as one beneficial effect of the war. Decrying the "Too little and too late" philosophy, he pointed out that a careful distinction must be made to prevent this becoming "To much that is not important." When ordering materials, only those absolutely essential should be included. A review of certain production statistics makes it evident that only the most imperative civilian needs of critical materials can be filled if military requirements are to be met successfully. In this the understanding and cooperation of water works authorities is highly desirable until the pinch has been relieved.

"Possibilities of Bacterial, Chemical, and Gas Poisoning of Public Water Supplies," by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc.

Since much of his data was confidential in nature and cannot yet be published, no report is made of Mr. Faber's discussion.

"Committee Report," by Wm. R. Conard, Chairman New Jersey Section Water Supply Committee.

Mr. Conard's committee was appointed in January of this year to investigate and to report on several matters pertaining to emergency operation of water supplies. His report indicated that adequate quantities of water are now available providing that present systems be completely utilized and protected; further, providing that all practical interconnections between various systems be made. This last provision is already made possible by a recent act of the State legislature which permits such interconnections through authority granted to the State Water Policy Commission.

"Committee Report," by Robert Shaw, (Chairman, Special Committee to cooperate with State Defense Council), Asst. Engineer, N. J. State Dept. of Health.

Mr. Shaw described the functions of his committee which is actively assisting in defense precautions by the State Defense Council, the State Water Policy Commission, and the State Department of Health. To accomplish greatest efficiency, the State has been divided into seven districts, each headed by a Coordinator and an Assistant Coordinator. Preparation of inventories with a master index in order to make supplies available in emergency is one of the large functions of this committee. A mimeographed outline of committee recommendations has been sent to all water works superintendents and others interested may obtain a copy from the Secretary of the Section.

The session closed with the customary Round Table led by Superintendents Ed. Hyland (Moorestown) and Vernon Smith (Park Ridge). Due to the lateness of the hour this part of the program was sharply curtailed.

Russell Smalley, Supt. Highland Park, N. J. and Frank A. Baker, Supt. New Brunswick, N. J.

W. H. ("Bill") Johnson Sales Mgr. Phoenix Met. Co., N.Y.C. and J. J. Donnelly Gen. Foreman New Brunswick, N. J.

Nate Miller, Supt. Maint. Highland Park, N. J. and C. C. Condon, Supt. Filt. New Brunswick, N. J.

Chester Lindner, Supt. of Maint. and J. L. Linder, Gen. Supt. Bayonne, N. J. (Mr. Lindner, Sr., having served the Water Dept. for 43 years.)

J. Arthur Carr Supt. and Engr. Ridgewood, N. J., Water Dept. and J. H. Murdoch, Jr., Atty. Am. Water Wks. & Elec. Co., New York City (President, Penn. Water Works Assn.)

SHORT CUTS SPEED OUTFALL SEWER CONSTRUCTION

By FLOYD SUTER BIXBY
LOS ANGELES, CALIFORNIA

THE palm fringed city of Riverside, California, 60 miles east of Los Angeles, has finished a very important leg of its Southwest Outfall Sewer, using some improved methods and new machines not generally employed on projects within the 35,000 population class. The new outfall leg is a part of an $800,000 sewer program, and involved problems which showed new all-purpose city machines up to good advantage.

The Southwest sewer follows a general line down the left bank of the Santa Ana River; a small, rapidly flowing stream with a 15-foot per mile hydraulic gradient. Cuts of various depths were necessary for pipe trench excavation, ranging from 6 feet on the level to a heavy 29-foot cut where the line dove through a lofty false point in the river bend.

Machines Purchased for the Job

A Bucyrus-Erie 15B machine was purchased by the city, not only for the sewer job but for a variety of other work encountered in Riverside as well. Dragshovel, dragline and shovel attachments were all purchased so that by quickly interchanging the booms the 15B machine would operate at its best advantage, whether the use be trench excavation, casting, or truck loading. A Cletrac 90 horsepower tractor, carrying an Isaacson bulldozer, was also purchased at the same time.

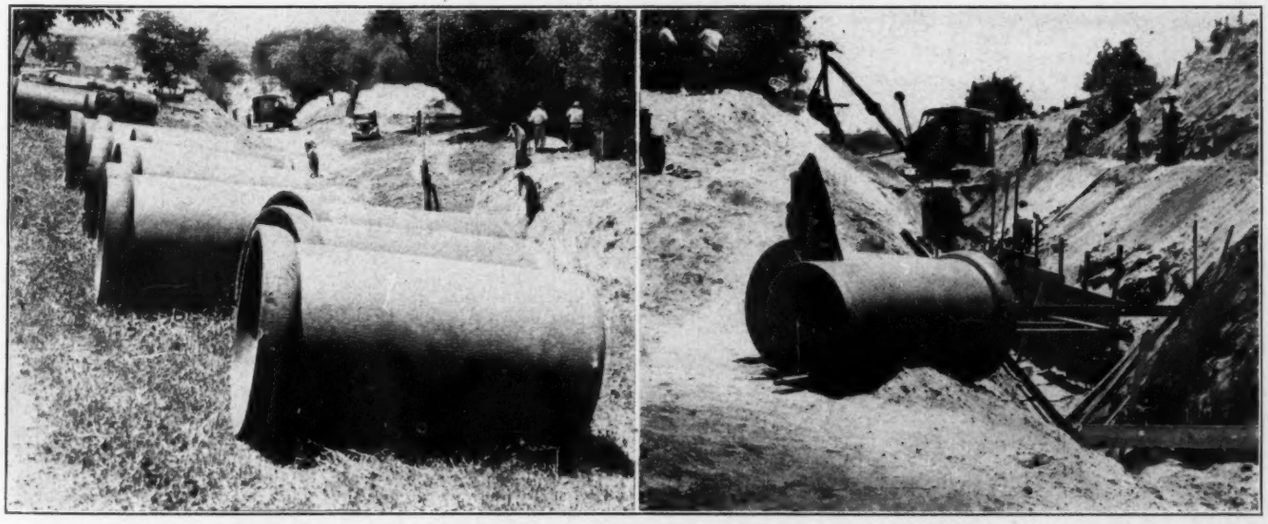
In laying the heavy 24-inch vitrified clay pipe, operations were started at the lower end of the job and carried toward the upper sector. Using a dragshovel bucket and boom, the 15B machine set to work scooping a ditch through formations of river gravel and sand. Fairly hard deposits of firm, tertiary sandstone were not uncommon where the sewer lay at the foot of eroded hills near the river.

When the construction approached the point where a 29-foot cut through a short false point was necessary, it was decided that the 640 cubic yard per 8-hour day production of the dragshovel would justify its use in the removal of the cut. Losing no time whatever in changing booms on the dragshovel, Operator Ray Holte dug a primary 13-foot slice off the area. As the material fell out of the bucket the Cletrac mounted bulldozer pushed it from 50 to 55 feet out of the way.

Dipper Capacity Increased by Simple Scheme

The capacity of the machine was increased on this cut by building up the back end of the digging bucket to prevent excess dirt from sluffing out over the back end. This was done initially by wiring two 2″x8″ Douglas fir boards to the rear bucket braces. Later, with a welding outfit the temporary boards were replaced with ⅜-inch steel plate stock, electrically welded to the dipper and its braces. This little improvement increased the capacity of the backhoe from ½ cubic yard to nearly ¾ cubic yards per swing.

The increased load, although it was not harmful to the 15B machine in the gravel at this point, did exert a considerably heavier strain on the control cables. Since the city had some previous experience with rope wear, the worn out non-preformed control cables were replaced after about 3 weeks of operation, using preformed 6x19 filler wire,



Riverside Outfall Sewer Construction

General View of Operations (left) and Second Trench Cut Being Made (right). Note Shoring to Hold Sliding Sand Bank in Place.

regular lay, on the boom line. The pull cable was replaced by a ⅝-inch preformed improved plow-steel rope, of 6x19 IWRC Lang Lay construction. After three weeks of more strenuous operation than before these ropes were far from worn out, for a close examination disclosed only two surface breaks in the most worn foot of these lines. They were single wire breaks. The increased service life of preformed rope was quite a revelation to Operator Holte and the oiler, who had never known exactly how much more wear it would stand under bending fatigue.

Trench Dug to Grade, as Follow-Up Operation

The preliminary cut was completed in a few days and the trench dug to grade on the secondary operation. Thorough shoring was necessary in this 16-foot deep trench. Timbers of 2″x8″ were used every 10 feet, with 4 spreader jacks between each set of timbers.

The pipe sections were cradled in rope slings and rolled in by hand

Close-Up of Dipper

Reveals How Its Capacity Was Increased by Building Up Back End with Planking.

labor when the 15B machine was not sufficiently advanced to act as a crane. The pipe sections were carefully placed on a subgrade trimmed up by the laborers. Joints were caulked with regular run jute, tamped securely in the back end of the inside of the bell of each section. Each bell was then filled full of Tegul Ampco silicon sulphate. This black material had to be broken out of containers, melted, and poured in the same manner that a lead joint is made. Backfill and trimming of the ditch was done by the Cletrac mounted bulldozer, which filled the ditch in 5-foot lifts. Each layer was flooded with water to hasten settlement.

These effective, up-to-date methods, finished a difficult job well ahead of schedule, and will help to insure adequate sewage disposal facilities for the entire southwestern section of Riverside. This part of the city is constantly growing, owing to an influx of officers and military personnel stationed at nearby March Field and Camp Haan.

SOME REAL NEWS

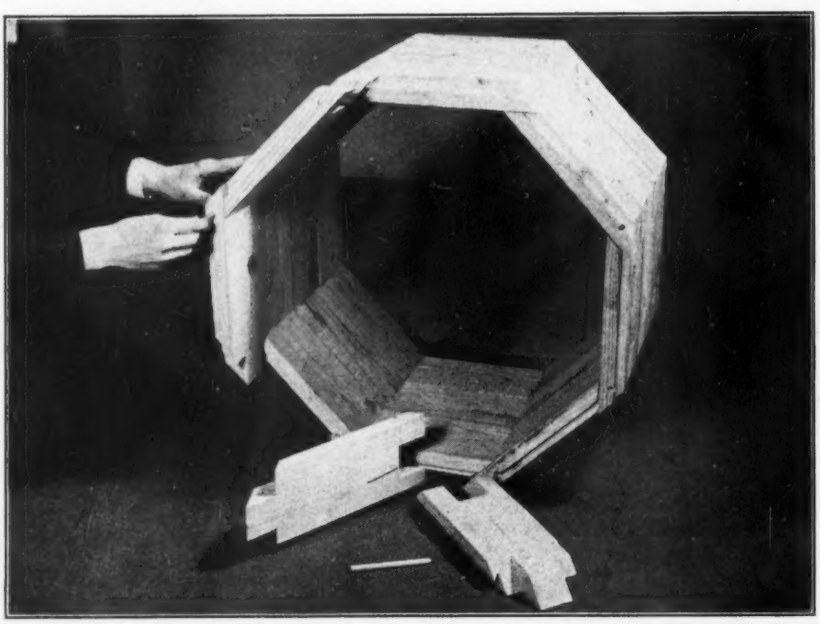
Steel Drainage Pipe Manufacturer Offering Wooden Product to Conserve Steel.

For many years "Armco" has been synonymous with drainage and water pipe of steel. In particular has the Armco Drainage Products Association spent much time and effort in promoting the use of and improving the quality, usability and durability of protected corrugated pipes for culvert, drainage and sewer construction.

Now, in view of the need for steel in the war, the Armco Association has developed a drainage conduit fabricated wholly of wood, after 38 years of steel drainage pipe development and production. The Armco wooden product certainly represents an "all-out" effort to meet WPB's demands that critical materials be eliminated wherever possible.

Unlike the ordinary box-type of structure, which is quite rigid, the Armco Emergency Pipe is made up of a series of short stout segments, given an octagonal or other polygonal shape, connected together in an ingenious way (with wooden pegs) to utilize the full strength of the material. The units are shop assembled or fabricated into length of 12 feet or more, which in turn are joined together simply in the field to make a single structure.

Strength tests show that the Emergency Pipe possessses many



of the structural characteristics of corrugated metal pipe. It has flexibility which enables it to build up side support and increases its load carrying capacity.

Increased durability is obtained by treating the wood with a non-critical material. In due time it is the hope of Armco, of course, that replacement will be made either by threading corrugated metal through the wooden structure or by jacking a metal pipe around it and removing the old structure.

A 4-page folder has been prepared illustrating and describing the features of the Emergency Pipe. Copies may be obtained from the Armco Drainage Products Association or any of its member companies.

N.E.W.W.A. DISCUSSES PROPOSED NEW WATER STANDARDS AND GUARDING PROBLEM

Ask War Department for Guidance in Latter; Hear That Water Utilities Will Be Allowed Recapped Tires for Essential Services

THE March meeting of the New England Water Works Association in Boston on the 19th was well attended by superintendents and managers seeking a solution for the water supply guarding problem; by chemists and sanitary engineers particularly interested at this time in the new U. S. Treasury Department Standards for Drinking Water at present being revised and tightened up in respect to required frequency of sampling, as well as in other directions.

A count of luncheon tickets revealed an attendance of 180.

The Water Works School

As is customary in connection with the monthly meetings of the Association, the Water Works School preceded the forenoon sessions of the superintendents and chemists, which are followed by a luncheon, a business session and the remainder of the afternoon is devoted to technical papers and discussions.

The topic chosen for the March Water Works School by Professor George E. Russell of M.I.T., was "The Effects Pipe Diameter on Rate of Flow and Size of Pipes in Distribution Systems for Adequacy of Fire Flows." He also went into the subject of fire-nozzles and hoselines, and is seen in an accompanying picture sketching a standard nozzle on the black-board.

This was the 5th lecture of the series given in the 1941-1942 "course" and the pictures indicate the interest manifest in Professor Russell's easy to follow lectures. A splendid commentary is the ages of superintendents and managers who come as frequently as permissible to the Water Works School.

Impressing his "class" with the fact that the pressure loss through a given run of main varies as the 5th power of the diameter, the Professor proved such by computations which indicated that with two fire streams of 225 gpm. each the pressure loss per 1,000 ft. of main (with a coefficient as good as C=100) amounted to exactly 86 times as much with a 4-in. main as with a 10-in. main and 12 times as much when comparing 10 in. against 6 in. Why 8-in. pipe is favored now as the smallest main for a respectable fire flow was shown by the fact that although the 8-in. pipe is only 2 in. more in diameter than the 6-in. size, the pressure loss is only ¼th as much in the 8-in. main. Further, as the C value drops below 100 this marked differential in favor of the 8-in. size becomes even greater. Another instance was the comparison of 10-in. against 6-in. pipe, in which the pressure loss for the two 225 gpm. streams is 1200% as great through the smaller pipe, although the latter is only 40% less in diameter.

The President
F. H. Kingsbury
Senior Engineer
Mass. Dept. Health

The Professor
Geo. E. Russell
Prof. of Hydraulics
Mass. Inst. Tech.

Superintendents' Session

Howard C. Mandell, Supt.
New Bedford, Mass.
Chairman

(Reported by S. S. Anthony, Supt. Augusta, Me., Water District.)

1st Topic—Guarding Water Supply Properties

Chairman Mandell opened the discussion with a statement that in his opinion, every thought and act of the water superintendent should be devoted to protection of his system in order to facilitate production of war materials. It is necessary to protect the system from sabotage and fifth columnists whose actions cannot be predicted. The time and place of their striking is unknown to all of us.

Recent history shows that stoppage of or reduced water supply eliminates all war activities. This fact is recognized by the War Department, but to date they have been unable to furnish guards for utilities. They state that it is our duty to guard adequately the weak points in our systems. It was suggested that water works superintendents seek the advice of the State Adjutant General or the Chief of the local or State police in the placing and organizing of their guard forces.

Major John H. Brewster, Sanitary Engineer of the U. S. Public Health Service was invited to talk. He stated that it is important to keep industry operative at maximum capacity at all times. The War Depar-

The Water Works School

(Motto—None is too old to learn nor too proud to sit on the front row)

While "Prof." Russell is sketching on the board, many are taking notes. Nearest the camera in the front row is Supt. H. B. Collins of Manchester, Mass., with Theodore Bristol, Pres. of Ansonia (Conn.) Water Co., also taking notes just beyond. In the row next is Supt. Horace Cook (Auburn, Me.)., Supt. Alan McAlary (Rockland, Me.), Supt. "Sid" Anthony (Augusta, Me.). Others we recognize beyond are Supt. Potenza (Medway, Mass.), Supt. Harold Brigham (Marlboro, Mass.), Chief Engr. Harry Fuller (Portland, Me.) and Johns-Manville's A. L. Rose.

ment recognizes this fact and places army personnel second to industry in many cases. We are warned to keep industry going at all costs and protect our systems from damage, repairing damage "with dispatch," to use army terms, which means immediately. It is also necessary to protect the health of the civilian population. It is for this reason that chlorine and chlorine compounds have been given an A-2 priority rating so that there will be no lapse in water purification.

He stated that water works operators as a whole are greatly interested in their responsibilities and have been attending meetings in large numbers to learn all they can about their duties. However, many things are not considered by the superintendent. We should see that the proper authorities give us all the assistance we need to carry on our jobs, such as labor and skilled help in emergencies to keep in operation. We should keep a representative in the local Report Center to see that the utility is informed promptly when damage occurs during a raid and see that other utilities and public works repair their damaged property promptly, so as not to interfere with the proper repairs to water property.

Major Brewster warned that Corps Area commanding officers are likely to demand the guarding of vulnerable spots in vital locations where war industry is active. The finding of guard personnel and the money to pay for them is the responsibility of the utility. He suggested that a great deal of thought be given to this subject. It is entirely possible, he thought, that war work contracts might be taken from industries where the utilities are not sufficiently guarded to insure continuous operation.

He asked the water superintendent to co-operate to the fullest extent with their State and zone co-ordinators. We will find them anxious to help, but they must be helped by the water works man in order to help them to help him.

New England, he stated, was far ahead of other parts of the country in getting their organizations in operation, but there are many details to be completed and that work should be carried on constantly. He urged us to study our problems and then confer with the co-ordinators.

Repair squads, composed of regular and auxiliary personnel should be trained and organized, with simulated "incidents" as problems to be dealt with.

(1)
Geo. C. Brehm, Supt. of Water, Amherst, Mass.

(2)
Theodore L. Bristol, President, Ansonia (Conn.) Water Co.

(3)
Chas. R. Moore, Asst. Engr., Portland (Me.) Water District

(4)
Eugene M. Reppucci, Water Works Contractor, Boston

(5)
William James Caird Marshall, Supt. of Water, Georgetown, Mass.
("His mother called him William; his fathercalled him James; but the fellows all know him as just "Scotty" Marshall)

He suggested that the water works employees should be the ones to shut off damaged water mains, *not air-raid wardens*, as has been tried in other places. Get the plumbers to help in making shutoffs. Possibly the air raid wardens might help to locate the gates, but they should not try to operate them.

Sewer breaks must be permanently repaired before water breaks in the same location are permanently replaced.

Questions and Answers

There followed a question and answer period, with Major Brewster answering some of the questions, while others were answered or discussed from the floor.

Q. What is to be done if there is no money available for guarding, etc., and the finance committee of the municipality refuses to furnish it?

A. Explain to them again the need and ask the aid of the water co-ordinator and the state health departments in explaining to them.

Q. How about guards for the supplies furnished to military and naval establishments by municipalities?

A. Go to bat with them, shut off water for a short time during a practice blackout to demonstrate the need of guards, and then take up the matter with the co-ordinator and eventually get in touch with higher authorities. There is a possibility that money in such cases will be provided.

Major Brewster stated that there is shortly to be made a survey by the Intelligence branch of the military to determine the need and locations for guards in vital defense areas. They will make recommendations, but there should be no relaxation pending such a survey.

It was also stated that, under emergency powers recently granted, the Governor of Massachusetts may order municipalities to guard essential points.

Q. How can the necessary money for guards be raised?

A. By increase in water rates, or tax bill, or by bond issue.

(One superintendent present stated that his system was guarded by the Home Defense unit, standing watches from 6 p. m. to midnight and 12 to 8 a. m. with the regular water works forces acting as guards during daylight hours.)

It was voted to appoint a committee to draw up proper resolutions to be presented to the afternoon session to be adopted. This committee was appointed by the chairman, and he named Arnold of Rhode Island, Chase of Boston, Gidley of Fairhaven and Fuller of Portland.

[The resolution drafted by this committee was later presented to the Association at the afternoon session and was approved.

In effect, the resolution directs attention of the War Department to the proven importance of water supply in war operations, and requests that duly qualified army officers be chosen to meet with representative heads of water works systems as a committee, the purpose being to work out a satisfactory solution to the problems of effectively guarding those municipal water supply sources and properties, the safety of which is vital to war industry and/or establishments of the nation's armed forces.—ED.]

2nd Topic—Emergency Repair Squads and Auxiliary Forces

The second portion of the discussion was on the subject of Auxiliary Forces and Repair Squads. Chairman Mandell stated that he doubted if any water utility is prepared to deal alone with arson, sabotage or relatively light demoli-

(1)
Henry T. Gidley, Supt. and Treas., Fairhaven Water Co., Fairhaven, Conn.

(2)
H. J. Brillhart, Supt. of Water, Framingham, Mass.

(3)
Malcolm P. Brown, Supt. of Water, Hamilton, Mass. (N.E.W.W.A.'s newest member)

(4)
John Howland Robinson, Supt. of Water, Concord, N. H.

(5)
R. H. ("Dick") Smith, Pittsburgh-National Meters, Boston

tion bombing raids and that outside assistance must be provided for in advance.

The Massachusetts Committee on Public Safety has organized regional committees, including, among others, water works and labor representatives who should be able to co-ordinate their efforts effectively.

It was suggested that water systems be divided into areas with full equipment and tools provided for each area, together with locations of gates and services and personnel to operate them. Some communities have organized with fire departments on mutual aid plans and others have organized plumbers and other classifications.

It developed that some towns have bought auxiliary pumps, useful for either replacements for damaged pumping stations or for extra fire-department use, with men trained from both departments to operate them for either use.

Some departments are painting the gate-box lids in a conspicuous manner to identify and locate them more readily. Many departments have bought their valve location records up to date and made ample copies of such records for adequate distribution to maintenance crews and placing extra copies, along with gate keys, at strategic locations where such can be readily obtained.

In Needham, Mass., a scheme of cooperation between the water and fire departments has been developed. This involves a team of eight men from the Fire Department and four from the Water Department. The 12-man team is making a study of hydrants and valves and their locations and operation. It is to be the responsibility of this Emergency Team to control the flow of water in the event of damaged mains, so as to insure maximum possible fire service. Thereafter, this same team proceeds to assist in the fire-fighting phase.

Chemists' Session

J. A. McCarthy
Chief of Laboratory
Lawrence Experiment Station
Chairman

Topic—Proposed Revision of Treasury Department Standards for Drinking Water

The purpose of the meeting was a free discussion of the proposed Standards for Drinking Water now under revision by the U. S. Treasury Department (U. S. Public Health Service) with the aid and guidance of a committee composed of representatives of water works associations, the State Sanitary Engineers' Conference, Am. Chemical Soc., and other interested groups.

The Chairman introduced Arthur D. Weston, Chief Engineer, Massachusetts State Department of Health—a member of the Revision Committee—who reviewed the 4th edition of the proposed draft of standards.

Possibly the most important addition to the Treasury Standards is the requirement of frequency of sampling of the supply, with particular emphasis on samples from the distribution system. The present requirement of number of samples examined monthly follows. It is based on population served, rather than volume as was the basis earlier proposed.

Population Served	*Samples Month*
Under 2500	1
2500 to 10,000	4
10,000 to 25,000	25
25,000 to 100,000	150
Over 100,000	300

Mr. Weston explained that the numbers of samples stipulated applied only to the *finished* water leaving the plant and samples from representative points in the distribution system. Samples taken through the purification plant would be in addition to the above minimums.

In reply to questions, he stated that when communities are served from more than one system the population on the individual systems governed in the required sampling schedule for each. The total number of samples could be comprised of those examined by the city, the State and/or commercial laboratories taken together.

As to the volume of sample inoculated in the test for coliform organisms, the original stipulation of 5 portions of 100 ml. each has been changed to "optional" and the older 5 portions of 10 ml. each has been replaced as "Standard Samples," thus removing the necessity for providing much new laboratory equipment and larger incubator capacity per sample examined. To many laboratories this was welcome news.

These two matters—number of samples and sample size—were the chief objections in the earlier editions of the revised standards which will take effect Jan. 1, 1944.

As to chemical contents and limitations, copper and zinc limitations have essentially been dropped along with calcium, magnesium, since concentrations sufficient to be considered injurious are so great as to render the water un-palatable or nauseating. The following limits in chemical content have been established:

Substance	*P.P.M.*
Fluoride (Fl.)	0.8
Arsenic	0.1
Lead	0.1
Selenium	0.05

As to number or frequency of chemical examinations, or sampling points, no stipulations are made.

In the appendix appears the following limitations concerning raw-water quality and degree of treatment required:

(1) Any supply showing a Coli Index (No. per 100cc.) of 50 or more must receive treatment.
(2) Any filtered supply showing a Coli Index of 5,000 or more must be pre-chlorinated or receive double coagulation.
(3) Reliance on pre-chlorination is limited to raw waters which do not exceed a Coli Index of 20,000.

Specifications for residual chlorine stipulate residual of not less than 0.2 ppm. in the finished water. In the case of chloramine treatment the minim residual is set at double—i.e., 0.4 ppm. minimum. It is stat-

(1) *Harold B. Scales, Chemist, Portland Water Dist., Portland, Me.*

(2) *Chas. J. Crump, Supt., Bourne Water Dist., Monument Beach, Mass.*

(3) *Don C. Calderwood, Engineer, Pennichuck Water Co., Nashua, N. H.*

(4) *Wm. ("Bill") Weed, Sales Mgr., Niagara Alkali Co., New York City*

(5) *A. A. Potenza, Supt., Water and Sewerage, Medway, Mass.*

(6) *Frank P. Hall, Supt., Water Works and Sewerage, Athol, Mass.*

(7) *H. W. Jacobs, Pres., Cement Lined Pipe Co., Lynn, Mass.*

ed as desirable to maintain 0.05 ppm. residual throughout the distribution system or at least 0.1 residual when ammoniation is also practiced—i.e., double the residual if present as chloramines rather than the more active forms of chlorine.

It was generally agreed that the 4th revision of the Treasury Standards being set up by the U. S. Public Health Service constituted a much more acceptable regulation than earlier editions. A question raised, which appears a highly proper one, was that concerning the ratio of samples per month to population served. That is—why the low number of 4 per month (less than 1 per week) for supplies important enough to serve population up to 10,000, and only 25 per month for those serving up to 25,000 people. Apparently the jump from 25 samples per month to 150 samples stipulated for the 25,000 to 100,000 population group requires study and adjustment. If the 5 samples per day (150 per month) is not more than justified for supplies serving from 25,000 to 100,000, then the 25 per month for the 10,000 to 25,000 group is far too few—which seems to be a supportable argument, when considering that this specification calls for an average of less than one sample daily from a system supplying up to 25,000 people—a sizeable system.

The Luncheon and Business Session

(President F. H. Kingsbury, Presiding)

Following the luncheon, attended by 180, the resolution reported at the end of the Superintendents' Session, requesting War Department guidance and cooperation in reaching a solution of the water works guarding problem, was presented and endorsed by vote.

In a previous meeting a resolution was passed calling attention of the automobile rationing authorities to the importance of water supply vehicle equipment and the need for securing tires for the superintendents' cars as well as service and maintenance trucks. In reply, the Tire Rationing Board, re-affirmed that no new tires would be available but that re-tread tires were to be available for essential services and suggested that water utility managers make application for such through their local priorities (or rationing) authority.

At this point the President directed attention to the fact that the War Production Board had issued a new order on chlorine and hypochlorites rendering it unnecessary for those ordering either for water or sewage treatment to supply the form PD-190 with orders. Chlorine and hypochlorites for water and sewage treatment had been given an A-2 rating to insure availability for these important uses.

A letter read from Fuel Administrator urges water supply authorities to lay in an ample supply of coal as early as permissible and thus relieve transportation facilities which will become increasingly burdened and necessary for advancing the war program as time proceeds. While there appears no fear of scarcity of coal at the mine mouth, the price is to come in transportation and advance ordering constitutes a service to the country.

April Meeting in Providence May Meeting in Manchester

It was announced that the next meeting (Apr. 23) is to be held in Providence, R. I.—Hotel Biltmore. The May meeting and Spring Outing will be held in Manchester, N. H., at the Manchester Country Club, on Thursday, May 21st.

Afternoon Session

There was listed for discussion in the Afternoon Session the question of whether or not the Annual Convention scheduled for Poland Springs, Me., in September should be held this year. However, this matter, after introduction, was considered ill timed and tabled for renewal at the May meeting.

Harry U. Fuller, Chief Engr., Portland Water District had, before postponement of further discussion, presented his comments. He was strong in his opinion that there should be no change in respect to "going about the waterworks business" and to him the thought of cancelling meetings of water works men was something not becoming waterworks men. His opinion was that the policy should be plan as usual and even a bit better; then if lightning should strike it would be time to call off meetings needed now perhaps more than ever before in planning for eventualities never in American water supply history before experienced.

Mr. Fuller used an apt illustration to the effect that waterworks men never stayed at home just because a blizzard or storm struck when he was preparing to leave for the job. Then why should they through some fear of what may be "tomorrow" defer a meeting planned ahead. To seriously consider doing so would be nothing less than "a show of faintheartedness." (Applause.)

Following this, two papers were presented:

"The Water Supplies of Barre, Mass.—Old and New" by Howard E. Bailey, Consulting Engr., of Boston.

"Hill, N. H.—a Planned Town," by John L. Hayden, Consulting Engr., Boston.

The meeting closed with an interesting film story depicting "Activities and Operations of the Boston Fire Department"—both enlightening and thrilling.

(Adjournment.)

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Buy Defense Savings Bonds and help finance the Victory Drive. At the same time you have an absolutely safe, high-interest-bearing investment.

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Send for Maintenance and Operating Instructions for the "Chicago" equipment in your plant, if you have lost or misplaced them. Give us the unit number from the name plate of the equipment, and we will promptly mail you the proper instructions.

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conference on wartime

water works problems

JUNE 21-25 » HOTEL STEVENS, CHICAGO

THIS SPACE CONTRIBUTED BY THE MANUFACTURERS OF AQUA NUCHAR ACTIVATED CARBON
INDUSTRIAL CHEMICAL SALES, DIV. W. VA. PULP & PAPER CO., 230 PARK AVE., NEW YORK

Length of 36-inch cast iron pipe recently taken up and re-used elsewhere in Fort Worth, Texas. Note date mark on pipe.

THE salvage or re-use value of cast iron mains which must be abandoned or relocated has always been an economy feature of cast iron pipe. Today it is of prime importance. Cast iron pipe will serve out its full century of useful life, either in its original location (which may be temporary) or re-laid elsewhere, even in another city. Many instances are on record of old cast iron mains taken up and re-used, or sold to other cities for re-use, or sold as scrap.

For example, the City of Fort Worth, Texas, was recently required by the State Highway Department to relocate a 36-inch cast iron main which had been in service about 40 years. The pipe was taken up, found in fine condition, moved to a new location and re-used.

It is impossible to foretell future requirements or population shifts in metropolitan cities but any public official can be sure that, when water or sewer mains must be abandoned or re-routed, the pipe can be salvaged or re-used, if it is cast iron pipe.

Pipe bearing this mark is cast iron pipe

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THOMAS F. WOLFE, RESEARCH ENGINEER,
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CAST IRON PIPE

JUNE 21, 1942 is the opening day of

The 62nd Annual Meeting of the American Water Works Association

All meetings and the exhibit will be staged in the Stevens Hotel, located on Michigan Avenue facing the lake front only a short distance from the main business district of this great "Second City of the Nation."

Attendance at the conferences has been increasing annually and it is hoped that this year will exceed all others. Due to this being a conference on wartime water works problems, its importance to the industry and membership cannot be overestimated.

Your Conference Planning Committee has arranged for ample hotel accommodations and for a fine exhibit of material and supplies.

Plan now to attend.

JUNE 10, 1942, closing date of the June

Convention and Reference Data Edition of Water Works and Sewerage.

One of the outstanding advertising "Buys" of the year—Last year's issue of over 400 pages reached an all time high for publications covering these two fields. — Plan now to be represented in this important issue.

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ORGANIZING AN EMERGENCY WATER WORKS REPAIR UNIT

By HORACE J. COOK
Engineer and Superintendent
AUBURN WATER DISTRICT
AUBURN, MAINE

THE water works repair unit of the Civilian Defense for the city of Auburn, Maine, is an outgrowth of the more extensive program of mutual-aid cooperation instituted by the Defense Committee of the Maine Water Utilities Association.*

Over a year ago the Association, foreseeing the present emergency, sponsored a defense school for water works employees. This course was under the direction of the University of Maine. The expenses were borne by the Federal government. The speakers were all experts in their special line and included were some of the best known engineers and scientists in the East. Mr. Stephen Taylor, a former president of the New England Water Works Association, was in direct charge.

After the conclusion of this course in July of 1941, the committee felt that preparations for real trouble should be started at once. Accordingly questionnaires concerning inventories of pipe, specials, gates, jointing compounds, equipment, emergency chlorinators, etc., and trained men available, were sent to every water utility in the State of Maine.

The State was divided into ten zones. From the number of miles of each size of mains in the zone, the amount of pipe, specials, gates, etc., which should be carried in stock was computed. Any water company which was low in any line was asked to make purchases at once so that sufficient material would be available in each area.

What Auburn Was Doing

While this work was being done by the Defense Committee, the Auburn Water District was erecting heavy woven wire fences around vital areas, installing flood lights, inserting extra gates to lessen areas of shut-off, arranging for guards and taking other precautions which it does not seem wisdom to publicize.

Having experienced some trouble in the use of local guards in the first

The Author

World War, a Great Dane was purchased as a watch dog at one building. He works 168 hours a week and doesn't kick about his pay—or his grub.

During this time, the less experienced members of our own crew were taught to run joints, to use tapping machines, and to do all the duties usually left to the more experienced men. A special course of training, one night a week, was carried on for this purpose. While they were all required to know the water system as a whole, each had to make an intensive study of the layout of the mains, gate locations, etc., in the special area which had been allocated to him.

Soon after Pearl Harbor, Mr. Howard Potter, Water Supply Engineer for the Maine Public Utilities Commission, was appointed State Coordinator of Water Utilities by the Governor. Mr. Potter selected two water works superintendents in each zone to act as coordinators for that area. These individuals were furnished with the complete inventories of all the water utilities in that zone.

In case of disaster, the superintendent in trouble calls his zone coordinator, telling him what is needed. The co-ordinator, from the inventories at hand, sends the material and men from the nearest town having the necessary stock. All companies are under strict orders to keep their inventories up to the amount reported in the questionnaires.

Plumbers Volunteering Services Being Trained

Acting upon the advice of the State Defense Committee, the Auburn Water District, which supplies water to the city of Auburn, Maine, appealed to the plumbers in the community to form the nucleus of the water works repair unit of the Civilian Defense. The response was immediate. Practically every plumber in the city signed civilian defense cards and was allotted to this unit.

Two meetings with these men (classes) have been held for the purpose of instructing them in the use of jointing compound, tapping pipe, putting on repair sleeves, etc.

The water main system was divided into as many areas as we have regular men who are capable of taking charge of repair work. Plumbers living in that section were assigned to that employee. In addition, several husky young married men who had deferred classifications were also "enlisted" to serve as diggers.

The teacher of chemistry at the local high school, and a chemist of one of the large mills have been prevailed upon to help in the sterilization of mains after trouble. Truck drivers, guards, office help, machinists, foundrymen, etc., were also enlisted.

A "Canteen" Organized to Feed Workers

Should bombing occur, the repair of broken mains may be a long job so a group of women was organized to see that food was available to the crews at the scene of disaster. In order to make doubly sure that we were fed, our wives were "conscripted" for this duty. Miss Evelyn Wincapaw, our clerk, will describe this organized service, which we refer to as the "Canteen," in a companion article to this one.

In case of alarm, and in order that one bomb will not put the entire organization out of commission, our regular men have orders to drive the repair trucks to certain specified locations near the storehouse. For the same reason, maps of the system have been placed in vaults of busi-

*The author of this article is Chairman of the Defense Committee of the Maine Water Utilities Association.

ness houses in four separate areas in the city.

Upon the alarm signal, the civilian volunteers will meet at a designated point in each section. As word of damage comes to the main water office from the Report Center, where one of our officials will be on duty, the regular water works man whose area is affected, will drive to the meeting point in his zone, pick up his helpers and go to work.

Water by Tank Truck If Need Be

According to a decision of the Director of Civilian Defense for the State, it is the duty of the water utility to deliver water by tank trucks to bombed areas where it may be days before water service through the mains can be restored. This duty has been assumed by Ira Safford, who was a captain in the Engineering Corps in the first World War. Emergency sources of water supply have been located and the water analyzed. A sufficient number of tank trucks with drivers has been enlisted for the delivery. Several manufacturing plants have offered to furnish dry steam under pressure to sterilize these. One source of steam under pressure, which is available in nearly every town, is the steam roller of the Highway Department.

Communication Service Insured

A great part of the Civilian Defense Plan is predicated on the supposition that the telephone system will remain intact. In order to function in case of the loss of this service, a group of boys about sixteen years of age, to act as messengers, has been enlisted through the aid of our junior high school principal, Mr. Galen Veayo. Some of those with bicycles will be assigned to each area to carry orders to and from the central headquarters, which is our own office. The office has been furnished with black-out curtains so that the work of directing the various crews in shutting off bombed areas can be carried on during a raid.

Auburn is a city of 20,000 population and has 70 miles of water mains and 3,400 services. At present the total enrollment in the water works repair unit is about one hundred. This number can be expected to increase, for as plans are developed for the protection of vital places, weaknesses appear elsewhere which hitherto have not been considered, and must be corrected.

DEVELOPING AN EMERGENCY CANTEEN

For the Auburn Water District

By EVELYN L. WINCAPAW
AUBURN WATER DISTRICT
AUBURN, MAINE

THERE have been many pertinent—and learned—remarks made concerning a state of war. I'd like to add that "War is Work." If you do not agree with me just ask the ladies who make up the Commissary or Canteen developed in conjunction with the Water Supply Repair Unit of the Civilian Defense Corps at Auburn, Maine. The members of this Canteen are wives of trustees and officials of the Water District, together with the women of the office force. The Canteen is established for the purpose of seeing that our men on emergency work are fed and otherwise provided for.

To begin my story—the first task was to decide what food should be served, how it could be prepared, and where it should be served.

What Food to Serve and How

The question of what to serve brought forth several things to be considered. The food needed to be "hearty" and provide quick energy. It also required easy preparation and transportability Then, too, the workman might be able to leave his job for only a few minutes, so it had to be easy to eat. This food should not be salty or likely to stimulate thirst unduly. In addition to all these considerations, the groceries must come in airtight containers, or tin cans, so that they could be purchased and stored against the eventuality or their need.

Then came the question of how the food could be cooked if gas, or electricity should not be available. In this connection, several areas were selected as being the most unlikely to be bombed. In these sections a canvass was made to find out who would have ranges burning either wood or fuel oil, and if the owners would be willing to turn their kitchens over to the Canteen in time of need. After compiling this information, several homes were selected—as widely scattered as possible. These homes, to borrow a term from the scribes and savants, were to be "strategic bases." Also a check was made on charcoal burners, and places where wood might be available for a bonfire, if the damage should be so widespread that stoves could not be used. Included in the "locating" campaign were large thermos jugs to carry hot, cold, or semi-thickened foods. Water supply springs, which test satisfactorily, were also included in this survey as a precautionary measure. Grocers in suburban areas were contacted, and their services enlisted if the need for securing additional supplies should arise either during the day or night.

The Canteen members have selected one central spot where they will meet, thereafter proceeding to one —or more—of the "strategic bases" nearest the repair crews. There they will prepare the food from the groceries which have already been stored at these bases.

We Break Into the News

The local newspapers have thought these activities newsworthy and some very favorable comment has been printed. As a result, our group has received many offers of assistance. In one case a near-by cafeteria placed both its facilities and staff at our service in an emergency. Need I say that all offers were accepted with alacrity, and with genuine and sincere thanks?

After all of the spider web of detail was worked out, our group went shopping—using the sample and quotation method with customary Maine thrift. We purchased in large quantities and then divided the supplies up, delivering a box to each "base." These boxes each contain tinned pea soup, crackers, coffee, evaporated milk, and a jar of sugar. Also purchased, and included in addition to the food, were soup dishes, cups and spoons (that could "take it"), waxed paper, a towel, and a can opener. By doing this,

each box is packed as a complete unit ready for serving at any location.

These supplies, it will be observed, can be used to best advantage for serving on a very short notice, and under emergency conditions. In case of a prolonged siege, more substantial meals could be prepared with the cooperation of the grocers. As warm weather arrives, the Canteen plans to procure some additional supplies that would be used for hot-weather meals.

As it is, right now the Canteen is prepared. And, just let an enemy head appear in sight and our women will also do their bit of front line defense with a soup ladle—well aimed and heartily delivered!

WATER AND SEWAGE PATENTS

(of Recent Issue)

Reported by
JULIAN F. SMITH
Associate Director
HOOKER SCIENTIFIC LIBRARY
CENTRAL COLLEGE
FAYETTE, MO.

Water Patents

Faucet Filter. Frank P. Blair. U. S. 2,270,924, Jan. 27. A filter with pipe connection in the form of an inverted T is attached to a water faucet so that the water chamber is above the filter bed.

Clarifier. Harvey A. Watson. U. S. 2,271,165, Jan. 27. A system for purifying well water has an aerator through which water from the well is passed to a sedimentation tank and then to a purifier tank.

Treating Boiler Water. Cyrus W. Rice. U. S. 2,271,499, Jan. 27. Reacting casein, gluten or cottonseed protein with phosphoric, lactic or citric acid and with zinc or aluminum to make a compound for treating water for boilers or heaters.

Water Purifier. Chas. H. Spaulding. U. S. 2,272,026, Feb. 3. Freeing water from impurities by precipitation in a conical settling chamber while flowing the water and reagent upward from the bottom of the cone so that clear purified water can be drawn off at the top and aggregated settled impurities at the bottom.

Swimming Pool Water. Kurt Pietzsch (to Buffalo Electro-Chemical Co.). U. S. 2,272,223, Feb. 10. Sterilizing and purifying swimming pool water by adding enough chlorine for complete sterilization, removing excess chlorine with hydrogen peroxide and then maintaining sterility continuously withdrawing small portions of water to be similarly treated and returned to the pool.

Water Main Cleaner. Wm. G. Lowry. U. S. 2,275,190, March 3. Cleaning mains with a device having segment cleaning blades on studs carried by a disk which is mounted on a shaft propelled by a piston.

Ion Exchange. O. M. Urbain and Wm. R. Stemen (to Chas. H. Lewis). U. S. 2,275,210-1, March 3. Exchanging anions and cations simultaneously in water by a blended reagent capable of both ion exchanges; and exchanging cations by means of a basic salt of an organic acid and an amphoteric metal.

Multipurpose Water Distributor. Leon A. Genetti and Andrew A. Drumm. U. S. 2,275,750, March 10. A device which filters water flowing through a pipe, washes the filter and cleans the pipe; has a casing which contains a filter medium at one stage of its functioning and a cleaning agent at another stage.

Water Treatment. Wm. R. Gibson. U. S. 2,275,954, March 10. A water clarification plant has coagulating, settling and filter basins arranged in a circular plan with the coagulating basin outside, then the settling basins surrounding the filter basins and a clear well under the basins.

Sewage Patents

Treating Sewage. M. W. Ditto and R. F. Leftwich (to Emulsions Process Corp.). U. S. 2,270,869, Jan. 27. Violently mixing sewage with an oxygen-containing reagent liquid flowing in a pipe under pressure, discharging the mixture into a pool of sewage and then through a deaeration channel to permit gases to escape.

Aerator. Gilbert C. Unger, Jr. U. S. 2,271,446, Jan. 27. Passing an aerating device across a body of water to throw up a conical spray while forcing a gas column downward into the rising cone of liquid, so that the surface tension of the liquid is broken and intimate contact with air is achieved.

Sewage Plant. Benj. V. Howe and Glen A. Izett. U. S. 2,272,004, Feb. 3. A sewage disposal structure has a receiving chamber opening through a slot into a settling chamber which is divided into two compartments by a riser reaching up from the bottom.

Degreasing Wastes. P. B. Streander (to Underpinning and Foundation Co.). U. S. 2,272,441, Feb. 10. In a degreasing and grit removing unit sewage is fed to the inlet end of a downwardly tapered tank and grit is collected and scrubbed in a grit channel above which an air lift causes upward flow at the middle of the tank and downward flow at the sides.

Flocculator. Geo. M. Darby (to Dorr Co., Inc.). U. S. 2,274,361, Feb. 24. Flowing liquid into a flocculating basin at two levels while subjecting it to horizontal deflection with V-shaped impeller paddles and deflecting blades under conditions which do not break up formed flocs in the liquid.

Sludge Digester. Frank A. Downes (to Dorr Co., Inc.). U. S. 2,274,953, March 3. A tank for biologic digestion of sewage sludge has a primary digestion chamber above a secondary digestion chamber, with means for pumping sludge into either or both chambers.

LICENSING DANGERS

By JOSEPH E. YOUNG
Superintendent-Engineer
WATER AND LIGHT DEPARTMENT
FERGUS FALLS, MINNESOTA

IT HAS almost been accepted as axiomatic that the absence of a rigid class system and freedom of choice of employment have contributed greatly to the development of this country. Licensing laws, covering many arts, trades and professions, have been passed in comparatively recent years to an extent that the freedom to choose one's employment has to a great extent been curtailed. Under guise of public welfare, various groups have pressured legislative bodies onto passing licensing acts. However, we know that such is not the whole truth. In some instances these laws have really had for their primary purpose, insofar as the groups have been concerned, the object of securing increased security and tenure of office, and/or increased emoluments to members of the groups licensed.

State vs. Group Control

Groups in the water works profession are among those who have been sold the idea of getting licensing laws passed in different states, under the assumption that such laws would be directly beneficial to members of the group. Many of these laws for water works operators, either in effect or proposed, differ in one important respect from similar laws passed by members of other professions. The important difference is in the method set up for the interpretation and enforcement of the licensing laws. It is generally the custom, when licensing laws are passed, to arrange to have the administration of such laws under the supervision of licensed members of the trade or profession which benefits from such licensing. But, many of the laws for licensing water works employees, either in effect or proposed, turn the power of administration and interpretation of the laws over to some bureau of the State government. Plumbers, barbers, hair dressers, and others (as a general rule) hold the administration of their licensing laws in the hands of members of their own profession. If licensing is desirable for water works men, their intelligence and integrity should be assumed to be equal to that of other professions. This being so water works operators should be allowed to administer their own licensing practices in a manner similar to that followed by other groups.

Bureaucratic Rule Undesirable

Water works men should be alive to the extra expense and nuisance inherent in bureaucracy rule. It has been my observation that after a governmental bureau is formed, it continually is asking for more authority, more employees, and more and more money to enforce such authority and pay the employees. I have also noted in the matter of licensing that some bureaus, in their quest for authority, are asking for laws which are in such detail that the expense of enforcement will be prohibitive. For example, it is not unusual that the United States Civil Service rates aspirants for the most important and higher paid positions on the basis of education, training, and experience, without written examination. In this regard it seems incredible that one water works licensing law, with which I am familiar, credits education and experience with only 40 per cent, whereas 60 per cent of the total credit may be obtained from a written examination. And. a proposed law states that in addition to education and experience, attendance at a water works short course to be held under supervision of the bureau enforcing the licensing law, is to be compulsory. The object of some of these rules and regulations seems to be, as an important health official has expressed it, to make each operator a *small unit* of the State Health Department.

These bureaus are forging for the water works profession fetters of rules and regulations which are taking on the appearance of a dictatorship that may make the proverbial shackling of Ethiopian slaves seem like daisy chains in comparison.

When these bureaus secure, as they seem to desire, not only the functions which rightfully belong to consulting engineers, but the right to dictate every small detail of design and treatment in water plants, the art of treating water will stand still and an additional expense will ensue as a further burden on the community. Experience shows that initiative, originality, or engineering economy can find no place under the rules of some of these bureaus.

Inexperienced Administrators

To this writer's opinion it becomes important to keep in mind the unsoundness of the situation when it is realized that a great many of the members of the bureaus who make and who will enforce these rules and regulations have had no actual experience themselves in the practical operation or management of water plants. If a water works superintendent is asked by a consumer if the water is safe for use, he must return an unequivocal "Yes" or "No." He cannot state, as I have seen stated by inspecting bureaus, "the apparent concentration of coli-aerogenes is zero" and have it accepted for an answer. Many of these advocates who expect to administer these licensing laws not only lack that experience so desirable for sound administration, but are actually inconsistent. In the first place, they imply that special abilities, training, experience, and other qualifications are necessary. In many instances, however, they rate attendance of a few hours at a short course, under their supervision, of the greatest value — in fact, of greater value apparently than knowledge acquired through education and actual experience. No other profession which seeks the respect of citizens would approve practice and grant certificates to persons after a few hours of listening to theorists' dissertations which may equip certain perspicacious listeners to pass a written examination. In fact, members of the legal profession have had passed laws in various states to the effect that no one, under penalty of a misdemeanor, can fill out certain legal papers unless he is skilled through education and experience in all phases of law. It would seem that if licensing were really essential to the health of the public, members of the bureaus enforcing the laws should also be subject to license and re-examination in a manner which they demand for practical water works men.

Local Control Has Not Failed

Under the present system of local control, water works have expanded over this great country, and the art of treatment has progressed to a higher degree than found anywhere in the world. The incidence of disease carried by water has been reduced under present and past water works operators to an insignificant amount. If the desire of the bureaus to save human life is real, much greater results could be obtained with greater economy through other methods. The fetters of bureau rules and regulations if once attached will never be loosened because the incidence of disease is now so low that the bureaus will claim, forever in the future, that this low incidence was due solely to their efforts.

One thing that should never be overlooked when these laws are advocated is that, despite any law passed now or in the future, the one in charge of the plant will carry the direct responsibility in case of disease caused by water from the plant. This is true regardless of any form of licensing or type of administration of the licensing act. It should not be necessary to state that most operators are fully aware of their responsibility.

The economical and American way to safeguard the public health would be to inform those operators not fully cognizant of their responsibility as to its extent. When managers of water utilities have certain standards to be met, which are within the realm of reason, the general rule is that they will meet and exceed these standards.

"Jim" Dunwoody Passes

James S. Dunwoody, Superintendent of the Water Department of Erie, Pa., died very suddenly of a heart attack on March 21st. He was approaching his 51st birthday.

Mr. Dunwoody was born in Waterford, N. Y., April 2, 1891, obtained his tuition in the Rensselaer Polytechnic Institute as a Sanitary Chemist under the renowned Dr. Wm. P. Mason.

When Erie was in the throes of a typhoid epidemic in 1911 Dr. Mason recommended Jim Dunwoody to the Erie Water Department. He made good, later became chemist in charge of Erie's New Filter Plant, and in April, 1919, was offered the position of General Superintendent of the Department which position he held up to his death. Some idea may be had of the high regard in which "Jim" Dunwoody was held in Erie as an executive when considering the fact that he was at one time perhaps the highest salaried water superintendent in America.

A public spirited leader, "Jim" Dunwoody was prominently known in Erie for his work with the Red Cross. He was an ardent and go-getting Rotarian, having served as president of the Erie Chapter and district governor of Rotary International. He was a member of Erie's University Club.

In the water works field he was equally a leader, having been a member of the American Water Works Association since 1913, past-chairman of its Central States Section, which he later represented as Director on the A.W.W.A. Board. He was past president of the Pennsylvania Water Operators Assn. and active in the Western Pa. Section of A.W.W.A.

To indicate how "Jim" Dunwoody stood in the public eye in Erie, it is a privilege to quote parts of one of the several editorials which appeared in the newspapers of Erie the day after he passed away:

"The sudden death of James S. Dunwoody was a distinct and grievous community loss."

"An able engineer and conscientious public servant, he was the man who developed the Erie water system to its efficient and healthy condition it is today."

"He came to Erie as a young engineer just out of college and tackled a big job * * * He engineered the cleaning up process and developed a modern water system of which we should be thankful and proud. 'Jim,' as he was affectionately called, has left us a monument to his endeavors—a monument that brought Erie from a typhoid ridden community to a healthy city with ample pure water for everybody."

Mr. Dunwoody is survived by his widow, one daughter and a son, James Dunwoody, Jr., now a student at Lehigh University.

E. T. Fishwick Passes

Edward T. Fishwick, vice-president and director of the Worthington Pump and Machinery Corporation, died on March 15 at his home in Glen Ridge, N. J.

Mr. Fishwick had been with the Worthington organization for 49 years and was senior vice-president of the corporation. He was also president and director of the Worthington-Gamon Meter Co. of Newark, New Jersey, a director of the Glen Ridge Trust Company; a director of the New Jersey State Chamber of Commerce and was formerly head of the Diesel Engine Manufacturers Association.

Diesels in Water Works Plants

(A Correction)

Under the above caption an article by W. F. Schaphorst appeared in our March 1942 issue on page 140. In this article an error in computation has been found by one of our esteemed and most careful readers—Don C. Calderwood, Chief Engineer, Pennichuck Water Works, Nashua, N. H., who has been good enough to point out the error which was not detected by Ye Ed! He states:

"This article contained some very useful information but I believe he made a slip in the last sentence when he stated that the fuel consumption would be 64.5 lbs./ hour.

If operating at 100 per cent load the fuel consumption would be 42 lbs./hour. While the fuel consumption at 25 per cent load would be 1.536 times that of full load per horsepower developed, as it is only developing 25 horsepower wouldn't the consumption be

$0.42 \times 1.563 \times 25 = 16.125$ lbs./hour

instead of 64.5 lbs./hour as given in the text?"

Mr. Calderwood's reasoning and method of computing the 16.125 lbs./hr. was called to the attention of Mr. Schaphorst, who replies that "Mr. Caldwell is 100 per cent correct. The error was in the manuscript. It is entirely 'on me' this time and I trust that it can be fixed up in a corrective note so that nobody will be misguided. Mr. Calderwood not only read the article, but he did some 'thinking' in addition."

Then Mr. Schaphorst pays us a decided compliment when he adds:

"It is obvious to me that your journal is *actually read.* Although I write for several other journals also, I get more questions and corrections, if an error appears anywhere in the article, from readers of the W.W.&S. than from any other. I would call this an important point in your favor."

While like most magazines, the publication of corrections is an "editor's nightmare," even though there may be some consolation in the observation that WATER WORKS & SEWERAGE is *actually read.*

A.W.W.A.'S WARTIME CONFERENCE PROGRAM

CHICAGO, June 21-25 — Hotel Stevens. The American Water Works Association has just released the Technical Program for its 62nd Annual Meeting scheduled for June 21-25, inclusive, in Chicago.

It is to be noted in particular that the 62nd meeting is not to be a "Convention," but instead, a "Wartime Conference," specifically devoted to topics and problems of the water works man in time of war. From the program, which is to follow, it is to be noted that the meeting will terminate at noon on Thursday, the 25th, rather than run through the entire day as previously customary.

To shorten the Conference, and save thereby a full day for many who attend, the customary "open afternoon" on Wednesday of previous meetings has been "closed" this year by continuing the Conference sessions all day Wednesday. The topics necessary to be covered, however, required the holding of forenoon sessions on Thursday. Otherwise the meeting would have ended with the Annual Dinner, which is being moved forward to Wednesday night with the idea of shortening the meeting.

Some of the Important Items

If there ever was a time when so many new situations confront water works men, we do not know when. Here are some of the questions for which answers have been sought in building the 1942 Conference Program: "What can we use instead of what?"; "How can it be gotten most readily and promptly?"; "How best to proceed in guarding properties?"; "How, and where, can the greatest assistance be secured when needed?"; "Organization for taking care of emergencies"; "How to keep the water works going when everything is hard to get"; "How the Mutual-Aid plan works"; "How can we hold onto it after the war?"; "Is a chlorine residual through to the ends of the system justified—if so, how best to reach this objective?"

A Priorities Clinic Arranged

During the entire Conference a special booth will be maintained in the exhibit hall for consultation on priorities matters. This sort of "Priorities Clinic" is being arranged so that those having specific questions pertaining to priorities may get them answered (we hope) at this booth. It is believed that, in any event, a trip of inquiry to A.W.W.A.'s special Priorities Booth will yield more information than several trips to Washington or elsewhere. Here is a real service offered by A.W.W.A. and the manufacturers to any who attend the Wartime Conference.

Exhibits as Usual?

NO—not as usual, but there will be exhibits of a new order.

We say "not as usual" because of the nature of the exhibits planned, rather than because of their fewness. In deciding to go forward with exhibits for the Conference, the Manufacturers' Association has planned to have the 1942 exhibits emphasize "Service Over Sales." The idea is to show users of equipment how to get the most out of what they now have; to give maintenance and repair information, looking to extending the useful life of equipment and the conservation of materials and supplies. In short, one may expect the manufacturers' exhibits at the Wartime Conference to be something of a water works school in maintenance, repairs and operation, rather than a sales promotion show.

Registration will be under way early and exhibits will be ready for those attending the Conference beginning Sunday morning, June 21.

In order to get the most out of the many instructive exhibits and advice at the special "Priorities Booth," without having to miss important parts of the Technical Sessions, it will behoove many to plan Sunday attendance.

The Conference Location

It would have been difficult to choose a location for the Wartime Conference which is more advantageously located with respect to the country at large than is Chicago.

And now, the Technical Program which, however, is subject to possible revisions.

THE TECHNICAL PROGRAM

MONDAY MORNING—JUNE 22—9:30 A. M.

General Session

Administrative Problems of Water Works in Wartime —H. H. Brown (Milwaukee); D. L. Erickson (Lincoln); L. A. Geupel (Evansville); K. K. King (Kansas City); L. G. Lenhardt (Detroit); H. S. Morse (Indianapolis)

Plans and Policies of The National Housing Administration—J. B. Blandford (Washington)

The War and Water Rates—R. Newsom (New York)

Water Purification Division

Identification of Microorganisms—J. B. Lackey (Cincinnati)

Controlling Aquatic Nuisances by Chemical Methods—L. F. Warrick (Madison)

Traveling Laboratory Control of Bottlers Operation—Bert Wells (Atlanta)

Specifications for Filtering Material Committee Report —Paul Hansen, Chairman

MONDAY AFTERNOON—JUNE 22—2:00 P. M.

General Session

Some Introductory Remarks on the Chicago Water Supply—W. W. De Berard (Chicago)

Curtailment and Reduction of Water Waste as Affecting Capital Expenditures—A. E. Gorman (Chicago)

Conservation of Critical Materials in Filter Plant Design—F. G. Gordon (Chicago)

Treatment and Equipment for Chicago's Filtration Plant—Paul Hansen and J. R. Baylis (Chicago)

Maintaining Efficiency of Equipment in Chicago's Pumping Stations—F. J. McDonough (Chicago)

TUESDAY MORNING—JUNE 23—9:30 A. M.
General Session

Guarding Water Works Property—
W. J. Scott (Hartford)
H. U. Fuller (Portland, Me.)
H. A. Van Norman (Los Angeles)

Effects of Air Attack Upon Utility Structures—
Walter Binger (New York)

The Mutual Aid System at Work—
Earl Devendorf (N.Y. State)
John Murdoch (Pennsylvania)
H. H. Potter (Maine)
C. W. Klassen (Ill.)

TUESDAY AFTERNOON—JUNE 23—2:00 P. M.
Plant Management and Operation Division

Good Practice in Water Works Management—
W. R. LaDue (Akron)

Choosing a Water Works Superintendent—
D. L. Maffitt (Des Moines)

Organization and Equipment for Emergency Repairs—
W. Victor Weir (St. Louis)

Water Purification Division

Methods for Residual Chlorine—
C. K. Calvert (Indianapolis)

Is Residual Chlorine a Measure of Bacterial Quality?—
Dr. Max Levine, A. Heller and R. Bender (Ames, Ia.)

Maintenance of Chlorine Residual in the Distribution System—C. R. Harvill (Houston); M. C. Hagar (Boonville, Mo.); A. R. Todd (Wheeling)

WEDNESDAY MORNING—JUNE 24—9:30 A. M.
Joint Session

Plant Management & Operation and Finance & Accounting Divisions

The Omaha Water Works—A Successful Business—
W. S. Byrne (Omaha)

Jonesboro's Successful Water Works Business—
Lloyd Rebsamen (Jonesboro, Ark.)

Survival and Retirement Experience with Water Works Facilities—(Committee Progress Report)—
E. H. Aldrich (New York)

Current Supply Problems—Round Table—
W. W. DeBerard (Chicago); Eugene Dugger (Newport News); G. L. Fugate (Houston); Marsden Smith (Richmond)

Water Purification Division

Conditioning Methods to Inhibit Corrosion, Committee Report—E. W. Moore (Harvard)

Critical Problems in the Boiler Feedwater Field—
M. C. Schwartz (Univ. La.)

Stabilization of Lime-Soda Softened Water—
D. H. Rupp (Topeka); C. P. Hoover (Columbus); Owen Rice (Pittsburgh); A. F. Mellen (Minneapolis)

Effect of Water Conditioning on Locomotive Maintenance—C. R. Knowles (Chicago)

WEDNESDAY AFTERNOON—JUNE 24—2:00 P. M.
General Session

Ground Water—A Vital National Resource—

General Nature of the Current Problem—
Dr. O. E. Meinzer (Washington)

Midwest Problems—Chas. B. Burdick (Chicago)

Southeastern Problems—Malcolm Pirnie (N. Y.)

Long Island Problems—Kyle Forrest (N. Y.)

Pacific Coast Problems—S. B. Morris (Stanford)

Steel Pipe Committee—Open Session

Opening Remarks—By the Chairman, W. W. Hurlbut

Rehabilitation of the Owens River Aqueduct—
W. W. Hurlbut (Los Angeles)

Report of the W. P. B. Technical Advisory Committee on Nat'l Emergency Specifications for Steel Water Pipes—R. Barnard (Middletown, O.)

A Proposed Manual of Design for Steel Pipe and Fittings—A Symposium

The Design of Ring Flanges for Steel Water Pipe—
H. O. Hill (Pittsburgh)

THURSDAY MORNING—JUNE 25—9:30 A. M.

Finance and Accounting

Studies of Consumers' Demand for Water—
H. F. Smith (Detroit)

Survey of Billing and Collection Practices in Cities of 100,000 to 200,000—G. F. Hughes (Denver)

Water Bills as Liens Against Properties—H. L. Meites (Chicago)

The Accounting Manual's Balance Sheet—
C. E. Moore (Roanoke, Va.)

Plant Management & Operation

Planning and Operating Storage in Distribution Systems—J. P. Schwada (Milwaukee)

Good and Bad Practices in Maintenance of Elevated Tanks—W. B. Davis (Chicago)

Methods of Handling Street Excavations—
D. D. Gross (Denver)

The Use of Compressed Air in Maintenance Work—
LaVerne Trentlage (Elgin, Ill.)

Copper Sulphate in Sewer Maintenance

Comments by
J. W. McAMIS*
Sup't of Water and Sewerage
GREENVILLE, TENN.

Mr. Hood seems to have covered the subject of root removal from sewers with copper sulphate in considerable detail, and the writer has little to add to his contribution on this subject in the March, 1942 issue of this magazine.

In Greenville, we have for a number of years been using copper sulphate placed in the manholes above the suspected stoppage and have also used the method of placing copper sulphate in commodes where sewage contributors were willing to cooperate to that extent.

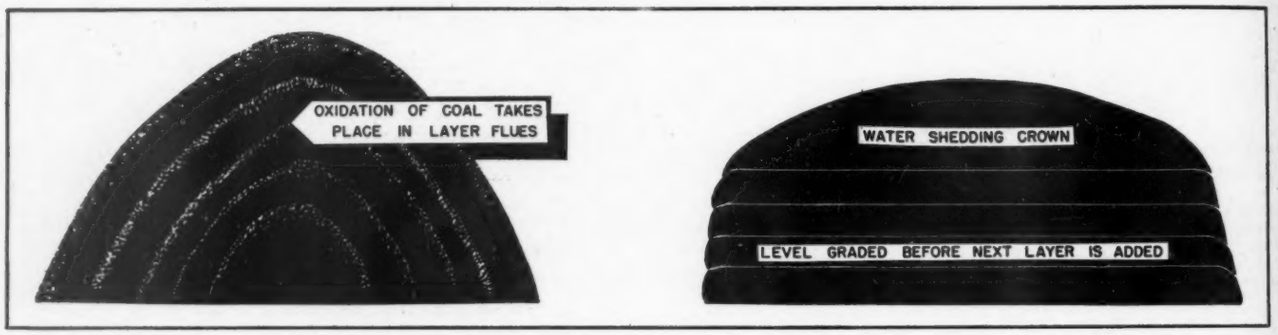
Mr. Hood's discussion of the necessity for thorough contact between the copper sulphate and the roots deserves stressing. This factor cannot be too greatly emphasized, and whatever failures have been encountered in the past can most certainly be laid to the fact that the copper has not been in contact with the roots for a sufficient length of time.

It is difficult to get men who know practically nothing of the strength of solutions to pay enough attention to this particular feaure, and when we have failed to remove the roots the writer is sure that this has always been the cause of the failure. Another point made by Mr. Hood to which the writer wishes to add emphasis is that where the employes can be taught the proper methods of application a great deal of time and labor can be saved by using the copper sulphate method. One man can make the application instead of using from two to four men wherever it is necessary to rod the sewers or use cables and windlass.

*Mr. McAmis, who we know to have long been using the effective copper sulphate dosing of troublesome sewers to kill the roots was sent an advance copy of the paper by Mr. John W. Hood, of Ridgewood, N. J., which appears on page 121 of our March issue.

Mr. McAmis was asked to contribute whatever he might have to add in the way of "sewer-coppering." We regret that the above statement did not reach us in time for its use in our March issue following the Hood article.—Ed.

Coal Piling to Prevent Losses



Sketches Illustrating How Coal Pile Structure Affects Heating

Temperature rise observed in conical piles was one-half degree per day; in the horizontal pile zero during a period of 18 months.

Now that we are doing everything possible to aid in production and conservation to bring more a speedy victory in this war, and with the authorities in Washington urging the early purchasing and storing of ample coal supplies, the method of storing this fuel supply to preclude losses in storage becomes an important and timely consideration.

In piling coal in open storage the danger of spontaneous combustion becomes an important problem. In recent years it has been shown that the method of piling bituminous coal is a consideration of moment in preventing oxidation and danger of spontaneous combustion.

Sometime ago we saw described a method developed by the Dow Chemical Co. of Midland, Mich., which seemed meritorious and we clipped the article from "Link-Belt News" for September, 1940, and it now appears timely to recount it.

The accompanying illustrations above tell the story in themselves. The basic principle is the piling in draft inhibiting horizontal strata in contrast with the more common conical piling, that results in draft "flues" through which air ascends to permit continuing oxidation and/or spontaneous combustion.

It has been observed that fine coal stored in conical piles shows a temperature rise of one half degree F. per day the average, and it is a general rule that chemical reactions are markedly speeded by temperature rise. It is also well established that coal piled in hot summer months is more likely to develop spontaneous combustion than coal piled in cold weather. It is also generally observed that spontaneous combustion usually originates at depths of 5 to 8 feet beneath surfaces of coal piles, *and mostly on the flanks of the pile.* Therefore a reduction of flank surface area becomes important along with the levelling off and compacting of the pile to secure the minimum flank area and obtain the least flue and "breathing" effects.

Dow Co. has, by the method illustrated, been successful in storing coal without observing any temperature rise within the pile in 18 months at least. The pile is built up very much after the manner of constructing earth-filled dams—i.e. with a Caterpillar type tractor and a carry-all to distribute the coal; and thereafter, the tractor with a bulldozer attached to spread and compact the layers at one operation.

If any reader wishes to have the method in more exact detail we shall be pleased to assist in securing such from the Dow Co. should copies of *"Link-Belt News"* for September, 1940, which contains the article, no longer be available.

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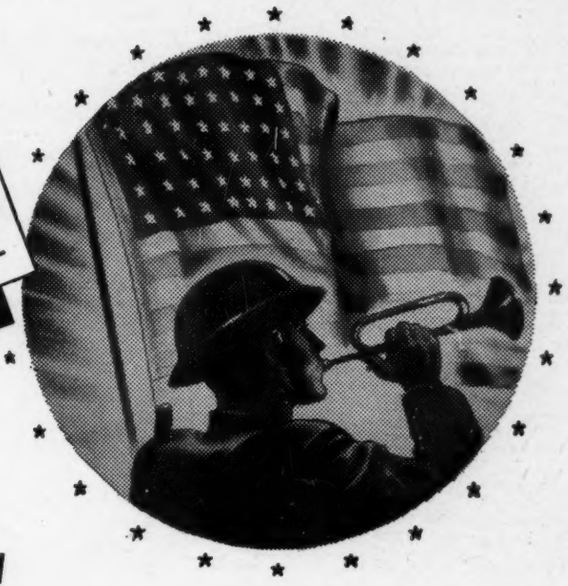

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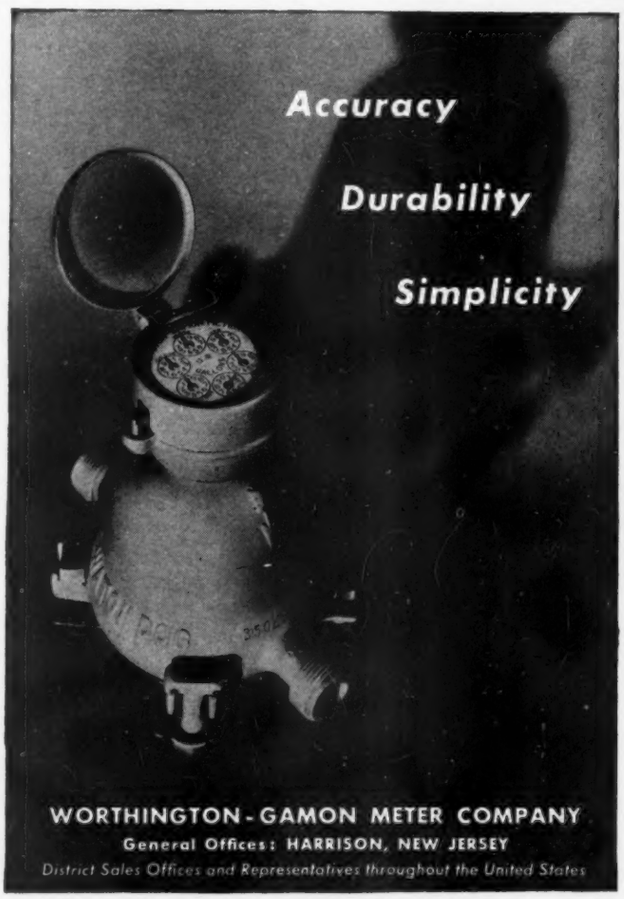

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MEETINGS SCHEDULED

Apr. 15-17—NIAGARA FALLS, ONT. (Gen. Brock Hotel)
Canadian Section A.W.W.A. Sec'y, Dr. A. E. Berry, Director, Ontario Dept. of Health, Parliament Bldg., Toronto, Ont.

Apr. 17-18—HELENA, MONT. (Placer Hotel)
Montana Section A.W.W.A. Secretary, Ralph Miracle, 713 Lewis Ave., Billings, Mont.
(Preceded by two-day short course Apr. 15-16)

Apr. 20—ATLANTA, GA. (Ansley Hotel)
Southeastern Section A.W.W.A. Sec'y, A. P. Rice, Supervising Engr., Reconstruction Finance Corp., Bond Service Div., Atlanta, Ga. (1 Day War Emergency Conference.)

Apr. 22-23—ROANOKE, VA. (Hotel Roanoke)
American Society of Civil Engineers. (Spring Meeting.) Secretary, George T. Seabury, 33 West 39th St., New York, N. Y. (The Sanitary Division Program is devoted expressly to defense topics.)

Apr. 23—PROVIDENCE, R. I. (Hotel Biltmore)
New England Water Works Association. (In conjunction with the New England Health Institute.) Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.
(Future Meeting—May—Manchester, N. H. (Manchester Country Club.)

Apr. 26-28—BAKERSFIELD, CALIF. (Motel Inn)
California Sewage Works Association. Sec'y-Treas., Jack H. Kimball, P. O. Box 355, Santa Ana, Calif.

Apr. 30-May 1—NIAGARA FALLS, N. Y. (Hotel Niagara)
New York Section A.W.W.A. (Spring Meeting.) Secretary, R. K. Blanchard, Neptune Meter Co., 50 West 50th St., New York, N. Y.

May 5-6—WAUSAU, WISC.
Wisconsin Conference Sewerage Works Operators. Secretary, W. J. Golucke, Sewage Treatment Plant, Route 1, Green Bay, Wisc.

May 6—WALLA WALLA, WASH. (Marcus Whitman Hotel)
Pacific Northwest Sewage Works Assn. Sec'y-Treas., Fred Merryfield, Assoc. Prof. C. E., Oregon State College, Corvallis, Ore.

(Meeting jointly with)

May 7-9—WALLA WALLA, WASH. (Marcus Whitman Hotel)
Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Assoc. Prof. Civil Eng., Oregon State College, Corvallis, Ore.

May 7-8—HAGERSTOWN, MD. (Alexander Hotel)
Maryland-Delaware Water & Sewerage Association. (16th Annual Conference.) Sec'y-Treas., C. J. Lauter, 5902 Dalecarlia Place, N.W., Washington, D. C.

May 14-15—TOLEDO, OHIO (Commodore Perry Hotel)
Ohio Section, A.W.W.A. Sec'y, Thomas R. Lathrop, 2328 Arlington Ave., Columbus, Ohio.

May 15—KENNETT SQUARE, PA.
Pennsylvania Water Works Operators' Ass'n. Sec'y, I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

(Meeting jointly with)

Southeastern Penna. Sewage Works Operators' Ass'n. Sec'y, Gordon J. Wiest, Sewerage Authority, Chester, Penna.

May 27-28—BOSTON, MASS. (Hotel Bradford)
New England Sewage Works Association. (Spring Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State Dept. Health, Hartford, Conn.

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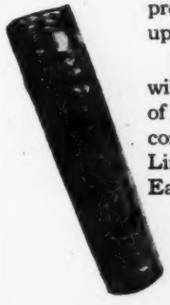

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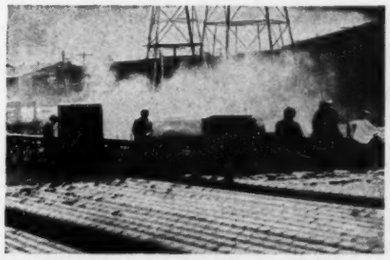

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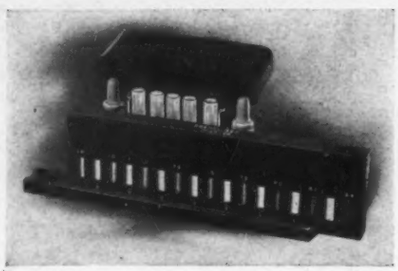

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MEETINGS SCHEDULED

May 27-30—GAINESVILLE, FLA. (University of Florida Campus)
Short Course in Water and Sewage Treatment. (10th Annual Meeting.) Dr. A. P. Black, Professor of Chemistry, Univ. of Florida, Gainesville.

June 4—NEW CASTLE, PA. (Hotel Castleton)
Western Pennsylvania Water Works Operators' Assn. Sec'y-Treas., I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

June 5-6—ALBANY, NEW YORK (Hotel Ten Eyck)
New York State Sewage Works Association. (Spring meeting.) Sec'y-Treas., A. S. Bedell, State Dep't of Health, Albany, N. Y.

June 8-11—CLEVELAND, OHIO (Hotel Statler)
American Society Mechanical Engineers. (Semi-Annual Meeting.) Secretary, C. E. Davies, 29 West 39th St., New York, N. Y. (Fall Meeting, Oct. 12-14, Sagamore Hotel, Rochester, N. Y.)

June 10—HOULTON, MAINE
Maine Water Utilities Association. (Bi-Monthly Meeting.) Secretary, Earle A. Tarr, Winthrop, Me.

June 18-19—MINNEAPOLIS, MINN. (Nicollet Hotel)
Central States Sewage Works Association. (15th Annual Convention.) Sec'y-Treas., E. J. Beatty, 458 State Office Bldg., Madison, Wis.

(Note the change in schedule of this meeting from October in the past to June henceforth. This year the dates were purposely chosen to immediately precede the A.W.W.A. Convention, which is to be held in Chicago, June 21-25, with a day for fishing in between.)

June 21-25—CHICAGO, ILL. (Stevens Hotel)
American Water Works Association. (Conference on Wartime Water Works Problems.) Executive-Secretary, Harry E. Jordan, 22 East 40th St., New York, N. Y.

Aug. 25-28—HOUSTON, TEXAS
American Society Sanitary Engineers. Secretary, J. W. Walker, City Hall, Waterbury, Conn.

Aug. 26—HARRISBURG, PA. (Penn-Harris Hotel)
Pennsylvania Sewage Works Operators' Ass'n. (Annual Meeting.) Sec'y, Bernard S. Bush, State Dept. Health, Harrisburg, Pa.

Aug. 27—HARRISBURG, PA. (Penn-Harris Hotel)
Pennsylvania Water Works Operators' Ass'n. (Annual Meeting.) Sec'y, I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

Sept. 9-11—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section, A.W.W.A. Sec'y, M. N. Gerardy, Sup't Water Supply, Water Board Bldg., Detroit, Mich.

(Meeting jointly with)

Michigan Conference on Water Purification. Sec'y, R. J. Faust, Dep't of Health, Lansing, Mich.

MEETINGS SCHEDULED

Sept. 15-18—POLAND SPRING, ME. (Poland Spring House)
New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 18—PITTSBURGH, PA. (Roosevelt Hotel)
Western Pennsylvania Section A.W.W.A. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 24-26—ST. PAUL, MINN. (Lowry Hotel)
Minnesota Section A.W.W.A. Secretary, A. M. Finch, Wallace & Tiernan, Inc., 416 Flour Exchange, Minneapolis, Minn.

Sept. 25—NEW LONDON, CONN. (Ocean Beach Pavilion)
New England Sewage Works Association.) (Fall Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State. Dept. of Health, Hartford, Conn.

Oct. 7-9—PHILADELPHIA, PA. (Benjamin Franklin Hotel)
Four States Section A.W.W.A. Secretary, H. Lloyd Nelson, 1624 Lincoln-Liberty Bldg., Philadelphia, Pa.

Oct. 12-15—
Southwestern Section A.W.W.A. Secretary, Lewis A. Quigley, City Water Works, 3320 W. Berry, Fort Worth, Texas.

Oct. 15-17—CLEVELAND, OHIO (Hotel Statler)
Federation Sewage Works Association. (3rd Annual Convention.) Sec'y, H. W. Wisely, Urbana-Champaign Sanitary District, Urbana, Ill.

Oct. 15-17—CLEVELAND, OHIO (Hotel Statler)
Ohio Conference on Sewage Treatment. (Meeting with Federation of Sewage Works Associations). Sec'y-Treas., W. D. Sheets, 568 E. Broad Street, Columbus, Ohio.

Oct. 18-21—CLEVELAND, OHIO (Statler Hotel)
American Public Works Association. (Annual Public Works Congress.) Exec. Dir., Norman Hebden, 1313 East 60th St., Chicago, Ill.

Oct. 19-21—PADUCAH, KY. (Irving Cobb Hotel)
Kentucky-Tennessee Section A.W.W.A. Secretary, H. D. Schmidt, Div. San. Eng., State Dept. of Health, Nashville, Tenn.

Oct. 22-24—ST. LOUIS, MO. (Coronado Hotel)
Missouri Valley Section, A.W.W.A. Sec'y, Earle L. Waterman, 104 Engineering Hall, University of Iowa, Iowa City, Ia.

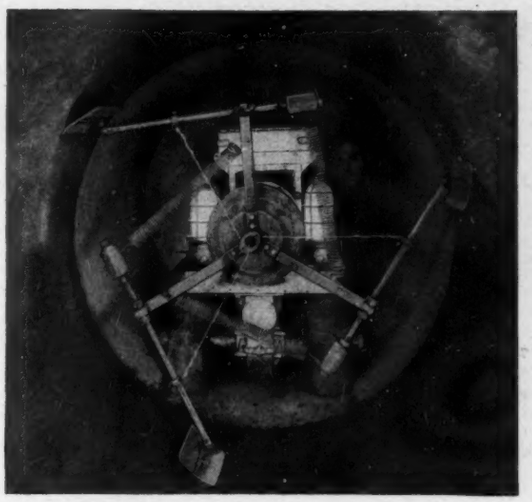
Oct. 27-30—ST. LOUIS, MO. (Jefferson & Statler Hotels)
American Public Health Association. Exec.-Sec'y, Dr. Reginald M. Atwater, 50 West 50th St., New York, N. Y.

Oct. 28-30—LOS ANGELES, CALIF.
California Section, A.W.W.A. Sec'y, H. Arthur Price, Dept. Water and Power, 316 West 2nd St., Los Angeles, Calif.

Nov. 2-4—DURHAM, N. C. (Washington Duke Hotel)
North Carolina Section, A.W.W.A. Sec'y, R. S. Phillips, Chief Chemist, Water Department, 206 Dacian Ave., Durham, N. C.

Is your water supply line a drain

ON THE CITY BUDGET?



....It's time to Centriline!

Have corrosion and tuberculation invaded your pipe lines? Are they *now* wreaking their costly destruction and decreasing carrying capacity? *Then it's time to recondition!*

A protective inner lining of dense cement, applied speedily and economically the Centriline way, will restore the high efficiency of your pipe lines. Providing an ever-smooth, non-corrosive, non-tubercular surface, this sleek new lining will permanently maintain a high coefficient and protect the underlying metal—whether steel or cast iron. Erase future depreciation costs and pumping expenditures. Centriline now and safeguard your initial investment.

Wherever your pipe line is situated, whatever its length—if its diameter is 30" or more—our men can quickly reach and recondition it. We welcome your inquiry.

CENTRILINE CORPORATION

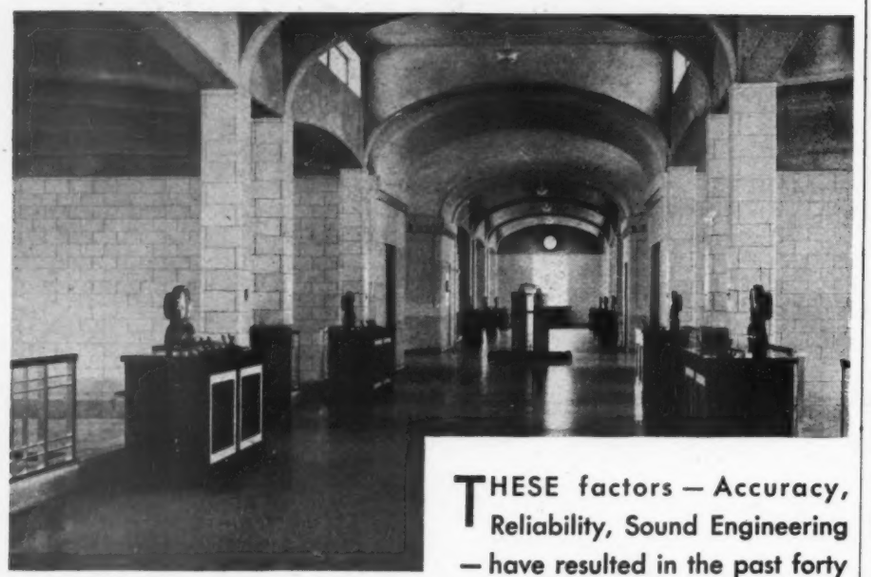
148 CEDAR STREET • NEW YORK, N. Y.

The Centriline process is a rapid and economical method of reconditioning pipe lines. It consists of first cleaning the main and then applying, by centrifugal force, a dense cement mortar lining of required thickness, mechanically troweled to a smooth finish.

RESTORES AND PROTECTS PIPE-LINE CARRYING CAPACITY

SIMPLEX

for ACCURACY • RELIABILITY
SOUND ENGINEERING
IN FILTRATION PLANT EQUIPMENT



THESE factors — Accuracy, Reliability, Sound Engineering — have resulted in the past forty years in the installation of Simplex Rate of flow Controllers, Gauges, Venturi Meters in the world's finest filtration plants.

First to develop the Direct-acting Controller, the Master Control, the Bell-shaped Float, and the Sand Expansion Indicator, the cardinal policy of Simplex is to increase its usefulness to the waterworks profession by continued research, design and cooperative measures with both designing and operating engineers.

SIMPLEX PLEDGES ITS ENTIRE FACILITIES TO MEET THE DIVERSE PROBLEMS OF THE NATIONAL EMERGENCY.

Simplex
Valve & Meter
Company
68TH & UPLAND STS.
PHILADELPHIA

LITERATURE AND CATALOGS

Sparling Main Line Metering is the subject of a brand new and complete General Catalog (with price lists) published just this month by R. W. Sparling, specialists in the design and production of the well known low-head-loss propeller type meters since 1919. Best known in the industrial and water works fields Sparling's low-head meters have more recently been extended to the measurement of sewage effluents, industrial wastes, etc.

The new catalog (amply illustrated) pictures and describes the several available types and styles of Sparling Meters and Indicating-Totallizing-Recording Units; also the simplicity with which these may be installed in existing as well as new pipe lines. Cut-away illustrations reveal the simplicity of the metering element—a six-blade propeller which revolves at speeds in direct ratio to volume flow and registers on a Totalizer connected through calibrated gears and shaft to the propeller.

Emphasis is placed on Sparling's Compound Meters, which operate at astoundingly low head-loss and in which there is no sharp cut-over point to be concerned over. The pressure-loss guarantee is something less than 2 psi. at full capacity, while registration accuracy is assured for range of flow as wide as 100 to 1.

Then are illustrated and described the several styles of Sparling Indicating, Totallizing and Recording Units and various mountings, amongst which is featured the recent 60 Day Recorders. These instruments employ strip-roll charts on which the flow record for the past 15 days is always in view without removal of the chart roll. The indicator and recorder reveal flows in terms of G.P.M. as well as M.G.D. This instrument operates by electric remote control (described and illustrated) to permit location at any desired distance from the meter proper.

Of interest in water and sewage treatment is the Sparling Auto-Metered Control Accessory for controlling chemical feed in ratio to flow rates, or for the operation of systematic proportional sampling of water, sewage, etc. Through the use of the Sparling 260 Sampler, developed originally for exact sampling of pulp. Other Sparling accessory equipment is also shown. There is a useful tabulation of specifications and prices of various units, and a

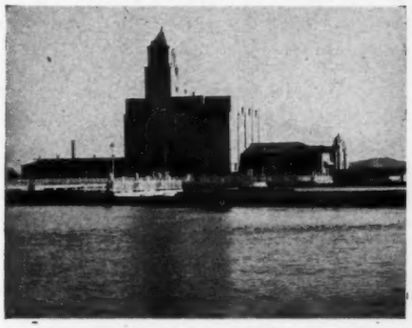
chart reveals the characteristics of various Sparling meters in terms of guaranteed accuracy, pressure loss, flow and velocity range for most accurate registration. The low maintenance cost Meterhead Exchange Service offered by Sparling is also described.

To our thinking the new Sparling General Catalog (issued as Bul. 308) is the most complete and informative of any ever put out by this manufacturer. For a copy write R. W. Sparling, 945 N. Main St., Los Angeles, or 101 Park Ave., New York City.

P.F.T. Floating Covers for single and stage sludge digesters are comprehensively described in Pacific Flush-Tank's new illustrated catalogue, No. 232, punched for inclusion in your office binder. All pertinent facts about separate sludge digestion are given in an early section of the catalogue. Later sections discuss the floating cover principle, construction and operating features of the P.F.T. equipment, and the advantages and economies in this method of sludge digestion control. Of first importance is the efficiency with which the P.F.T. floating cover keeps surface solids constantly submerged, hastening digestion and eliminating the need for removal of scum. Gas is collected at all times at a uniform pressure, which enables it to be economically utilized for power. Odor nuisances are minimized. Starting up is particularly efficient by operating the cover at its lowest position and thereby saving on the amount of auxiliary heat required. Besides design and construction drawings, the catalogue contains several photographs of municipal systems using P.F.T. covers. Largest of these is the plant at Cleveland, Ohio, serving a population of approximately 900,000 persons. Second in size is the four 90 ft. diameter units at Buffalo, N. Y., serving 750,000 persons. Floating cover designs are available for tanks from 10 to 110 ft. in diameter; installations have been made as large as 105 ft. circular and 95 ft. hexagonal. Complete specifications are given. For a copy of Catalogue 232, write to Pacific Flush-Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

ONE OF THE

WORLD'S LARGEST WATER SYSTEMS



Water Treating Plant, Metropolitan Water District of Southern California

100% *Beckman* pH CONTROLLED!

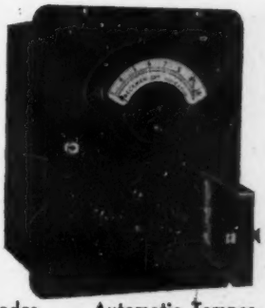
IMAGINE a giant water system capable of delivering ONE BILLION gallons of water *per day* across the entire state of California. That's the $200,000,000 Metropolitan Water District, *one of the largest construction projects of all time!*

With millions at stake, no chances could be taken with inferior equipment. That's why the Automatic pH control on this vast project is *100% BECKMAN!*

In the giant treating plant where the water is softened and purified, BECKMAN pH Instruments control the pH of the liming process . . . the pH of the carbonation process . . . and the pH of the final treated water.

No finer tribute than this 100% installation could be paid to the unfailing dependability and outstanding quality of BECKMAN pH Equipment!

WHAT YOU CAN DO WITH BECKMAN pH CONTROL!



This Beckman Automatic pH Instrument can take over the complete pH job in your plant. It will not only give *automatic* and *continuous* indication of pH in your water treating operations, but it can also be equipped to give a full pH *Record* for future checking and completely automatic pH *Control* over your processes. You can set the instrument to maintain optimum pH conditions at all times, thus insuring more uniform water treatment . . . and eliminating "overdosing" and waste of chemicals.

This instrument is the most advanced pH equipment you can buy, operates from standard 115 A.C. current and incorporates all of the newest pH developments such as Sealed and Shielded Glass Electrodes . . . Automatic Temperature Compensation . . . *Full* Alternating Current Operation (no batteries) with built-in voltage regulator . . . use of Beckman High pH and High Temperature Electrode assemblies for difficult conditions . . . and many others. Send for Bulletin 16 which gives complete details on this outstanding instrument!

THERE IS a Beckman pH Instrument for every size and type of water treating job from the *Automatic* instrument described above for large-scale operations to *portable* instruments for plant and field use. Send us details on your particular problem and our engineering staff will be glad to make specific recommendations!

NATIONAL TECHNICAL LABORATORIES • SOUTH PASADENA, CALIF.

WORLD'S LARGEST MANUFACTURER OF GLASS ELECTRODE pH EQUIPMENT

Beckman THE LEADING NAME IN pH

Prepare for Emergency with

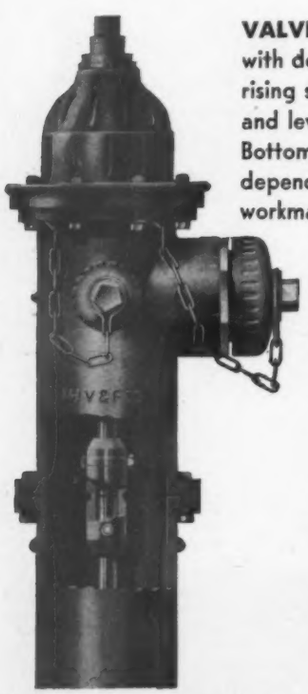
M H

VALVES HYDRANTS AND WATER WORKS ACCESSORIES

M & H PRODUCTS INCLUDE

Fire Hydrants
Gate Valves
Tapping Valves
Wall Castings
Special Castings
Tapping Sleeves
Check Valves
Floor Stands
Extension Stems
Shear Gates
Mud Valves
Valve Boxes
Flap Valves
Sludge Shoes
Flange and Flare Fittings
Flanged Fittings
B & S Fittings
Cutting-in Tees

Emergency fire-fighting facilities often may be improved by installing more valves and hydrants than normal, also keeping larger stock of extras for emergency. M & H Products are well known for high quality and expert workmanship, have been widely used for many years.



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square Bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL (shown at left) is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

Taste and Odor Control—a Bibliography. In the March issue of Industrial Chemical Sales' *Taste and Odor Control Journal* appears the first installment of an exceptionally complete bibliography of published articles pertaining to the important matter of taste and odor control in water treatment. The list of references to the literature includes 210 items in the first of a series to appear, covering the period 1902 to date. Already 800 references have been compiled and the bibliography will require several issues for its completion. The list has been compiled by W. W. Hassler of the Harrison Laboratories in the University of Pennsylvania. Anyone not already receiving the useful *Taste and Odor Control Journal* should not miss the opportunity to secure for permanent filing and reference the exhaustive bibliography on Taste and Odor Control. The Journal is distributed gratis and the reader should request being placed on the waiting list of the Industrial Chemical Sales Div., West Virginia Pulp & Paper Co., 230 Park Ave., New York City.

Aquatic Weed Control is the topic featured in the latest issue of *"Cloroben News."* This particular story has been taken from a "Report on Aquatic Weed Control at Cranbury Lake, N. J.," issued by the N. J. State Board of Conservation and Development. It relates and portrays by pictures the successful results secured from application of the liquid chlorinated hydrocarbon "Cloroben" in the cleaning up of a 35 acre section of Cranberry Lake infested with aquatic weed growths, the predominating species being *Potamogeton Robbinsii* (Robbins' Pond Weed) and *Brasenia Schreberi* (Watershield).

Also in this same issue of *"Cloroben News"* is discussed the application of liquid "Cloroben" in the control of insect breeding, with particular reference to mosquitoes and flies; also its use in general sanitation, as a deodorant, bacteriacide and larvacide for privies and latrines. It is offered as a substitute for hypochlorites and chlorinated lime needed elsewhere for other duty.

For a copy of the Spring 1942 issue of *"Cloroben News"* and additional information pertaining to Aquatic Weed Control, write The Cloroben Corporation, 225 Mercer St., Jersey City, N. J.

ACIPCO's War Map has come to us through the courtesy of American Cast Iron Pipe Co. The folder consists of a large map of the Pacific Ocean, on the reverse of which are detailed maps of Japan, Indo-China, East India Islands, the Philippines and Hawaii. The large map shows all important naval bases and stations and the areas held by the Allies and Japan prior to recent troop movements. However, we understand that new editions are to be distributed as such become available. For a gratis copy write to the American Cast Iron Pipe Co., Birmingham, Ala.

Rex Speed Prime Pumps is a line of self-priming, general utility portable centrifugals with motors, available in sizes of 3,000 g.p.m. to 125,000 g.p.m. These units are described in Chain Belt's new Bulletin 400, a generously illustrated 22-page book which explains in detail all constructional features of these Rex pumps. Most prominent is the patented "air peeler," a sharp-edged blade mounted above the impeller. The duty of the "peeler" is to remove air from the outside of the impeller veins and deflect it to the discharge, thereby increasing priming speed. Other features described and illustrated include a special suction valve, which prevents water from escaping down the suction line when the pump is at rest; and the re-circulating valve, designed to seal the re-circulation passage when the pump is primed. Complete specifications and illustrations of all models are given. Smallest in the line of pumps is the "Rex Jr." 3M, weighing only 57 pounds, but capable of efficiently moving 3,000 gallons per hour. The bulletin contains simplified data on "how to figure the right pump for the job," including tables of pipe friction, practical suction lifts for various altitudes, elbow friction and pressure conversion. For a copy of the new Speed Prime Pump Bulletin 400 address the Chain Belt Co., Milwaukee, Wis.

Byers' New Pipe Catalog—No, there's no mistake in this. It's a fact, A. M. Byers Co. has just issued a new General Catalogue for 1942, covering their complete line of wrought iron and welded steel pipes, tubing and other products. Wrought iron products listed include standard pipe, extra strength pipe, well casing, drive pipe, plates, angles, and channel iron. Welded steel tubing was

This is the season for water and mud and for

Homelite Portable Pumps

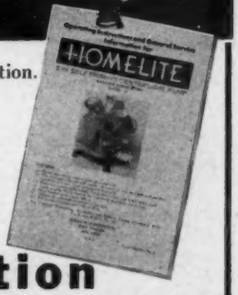
Save Man Power and Man Hours

Don't let spring thaws hold up your work. Put Homelite Portable Pumps on your jobs. These 15,000 gallon per hour pumps dewater ditches and manholes in practically no time —and being self-priming they sop up seepage automatically. They eliminate delays — make it possible for men to start working quicker. And being easily moved around by one man and self-operated by built-in gasoline engines, these 91 pound units do not tie-up scarce labor on pumping. They let your men free for more important work.

Keep 'Em Pumping Longer

It's easy to keep Homelite Portable Pumps in top condition. Simply—

- 1. Make sure suction hose is tight and not leaking.
- 2. Always use a strainer on suction hose.
- 3. Always mix ¾ pint of No. 40 oil with each gallon of gasoline used.
- 4. Keep breaker points set at .020 in. Send for helpful service manual.



Homelite Corporation

2504 RIVERDALE AVE., PORT CHESTER, N. Y.

An Important Message from Stuart-Brumley Corp.

IN the interest of national defense, it has been pointed out that many box cars could be released for service if 30 tons were placed in a car instead of the minimum 20 tons.

During this crisis, we are asking consideration that a 30-ton car, or even a 40-ton car, be ordered instead of a minimum 20. This will release for other services many extra box cars.

STUART-BRUMLEY TELLS HOW TO CHOOSE THE *RIGHT* COAGULANT FOR YOUR PLANT.

BLACKALUM

$1.50 per cwt. f. o. b. Baltimore carload lots

A POWERFUL DEODORIZING AND DECOLORIZING COAGULANT

Activated Blackalum is an outstanding premium coagulant at $2.00 more per ton. It won't allow sludge to ferment in the basins. It is fast flocing over wide pH range. It is for the superintendent who will pay a little more to get complete satisfaction from winter coagulation worries.

ACTIVATED ALUM

$1.40 per cwt. f. o. b. Baltimore carload lots

ECONOMICAL CONTAINS HIGH ALUMINA

Standard Activated Alum is one of America's largest selling coagulants. It is the type preferred by the alert superintendent who wants maximum coagulation economy with greatest efficiency.

STUART-BRUMLEY CORP.
516 N. CHARLES ST. BALTIMORE, MD.

Stuart-Brumley Corp. offers better service . . . better products . . . and Activated Alum and Blackalum are better liked daily

Other products of Stuart-Brumley Corp.: Co-Res-Co Protective Coating for steel and cement; Palmer Filter Bed Agitators; Tate Cement Lining in Position; Champion Activated Carbon; Chlorinated Bleaching Clay.

EDSON'S NEW HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs. Size No. 1.

THE EDSON CORP'N
49 "D" Street
So. Boston, Mass.

NEW YORK: 142 Ashland Pl., Brooklyn

Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office: 140 Cedar St., New York, N. Y. Factory: Medford, N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

added to the Byers' stock several years ago, and they have recently increased their line to also include standard alloys and heat resisting alloy steels. The 62-page catalogue is composed largely of tables giving dimensions, weights and strengths of pipe and other products. Complete specifications are given, along with notes on mill standards. An interesting chapter is that headed, "How to Order Pipe and Tubular Products." More interesting still is the fact that Byers has issued a pipe catalogue at all for 1942.

A copy of Byers' Catalogue (1942) can be obtained by addressing A. M. Byers Co., Pittsburgh, Pa.

Pressure Recorders, by Foxboro. The factual information contained in Foxboro's new Pressure Recorder Catalog is arranged so as to be of greatest time-saving convenience to the reader in selecting the Pressure Recorder best suited to his particular needs. The Foxboro line is well illustrated and described, covering instruments for the measurement and recording of pressures of all kinds, in ranges from 1 inch of water to 20,000 psi. A complete list of standard ranges is given, accompanied by full-size reproductions of specimen charts. In addition to other construction features of Foxboro Recorders, the various types of pressure measuring elements are illustrated, with an explanation of the conditions under which each is most suitable. Other sections of the 32-page catalog describe methods of instrument mounting, types of cases available, integral electric signal systems and accessory equipment.

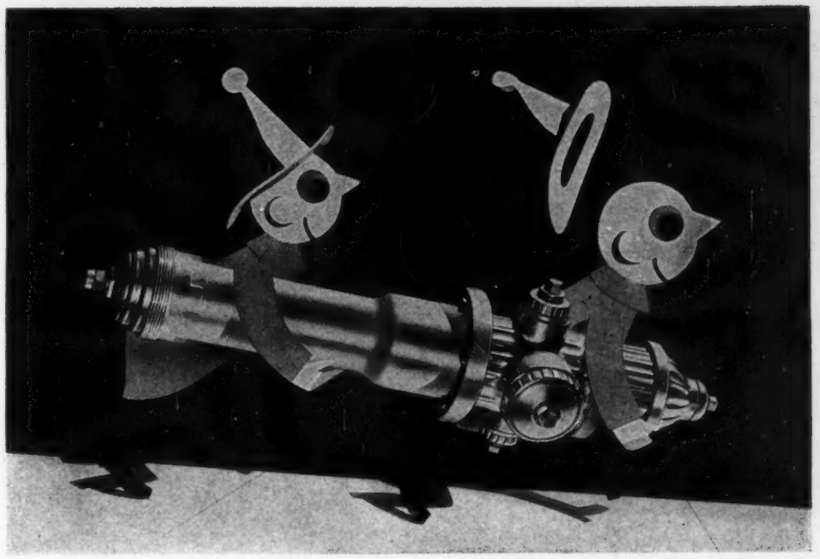
If interested, ask for Pressure Recorder Catalog 22-A. The address is The Foxboro Co., Foxboro, Mass.

"Electrifugals" — The compact motor-pump units of Allis-Chalmers, available in capacities from 10 to 2,750 gpm. and for heads up to 575 feet, are described and pictured in a new 36-page bulletin. Performance data, engineering recommendations, head capacity tables, and dimension charts are given to facilitate selection of the proper pump for the job. Photographs of installations at the water works of a large city and at a municipal filtration plant are shown. The bulletin also contains explanatory chapters on computing pumping head, friction of water in pipes, and valve and pipe fitting resistance. For a copy of this bulletin (B6018-B) write to Allis-Chalmers, Milwaukee, Wis.

American Well Works of Aurora, Ill., important producers of pumps and other equipment for water and sewage works, trace the history of this company back 73 years. This boast and interesting data about their personnel and manufacturing methods is given in a large decorative folder lately issued. Water and oil lubricated deep well turbines are illustrated, along with several lathes and impellers used at the plant. The folder includes a list of the better known "American" products, more about which may be learned from American Well Works, 100 North Broadway, Aurora, Ill.

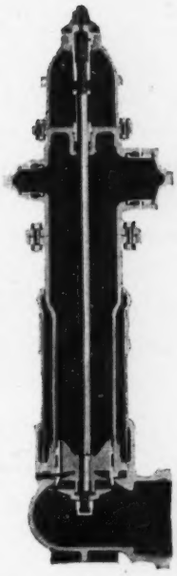
Butterfly Valves are featured in a 16-page illustrated catalogue recently issued by the R-S Products Corporation. Construction details and various methods of manual and automatic control are illustrated. Butterfly valves are manufactured in sizes from 2 in. to 84 in., and are recommended for regulation and shut-off of air, gas, steam, liquid, and semi-solid materials. Wafer type valves are furnished with free revolving vanes or with vanes which close at a slight angle. The catalogue contains complete specifications, several flow charts, and a discussion of the use of bronze, steel, meehanite and other metals for special operating conditions. For additional information write for Catalogue No. 10-B, from R-C Products Corporation, 4530 Germantown Avenue, Philadelphia, Pa.

How to Get the Greatest Capacity From Your Present Plant, is discussed in an introduction to the new Rex catalogue describing their line of belt conveyors, apron conveyors, and bucket elevators. The answer is to make certain that material flow is sufficiently fast and steady to keep your machinery operating at maximum efficiency. Rex belt idlers, one-piece replaceable cylinders with tapered roller bearings, are designed to maintain dependable and efficient belt-conveyor service. The Bulletin is illustrated with photographs of conveyors and bucket elevators in action in various industries. The 9.6 mile belt used during the construction of Shasta Dam is shown. Ask for Bulletin 410, from the Chain Belt Company, Milwaukee, Wis.



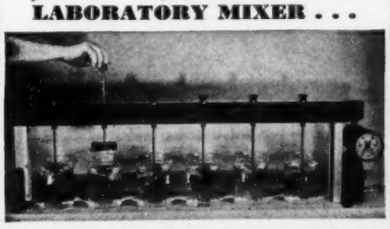
"WE NEVER DIG—
OUR HYDRANTS ARE MATHEWS"

Traffic smash? Check a drain valve? Street being lowered? General overhaul? You never order out the pick-and-shovel crew to service any Mathews Hydrant. Just unscrew the entire barrel from the elbow, lift it out through the loose protection case, and go to work. Replace it with a spare barrel if you wish. It's easy as changing a tire, for barrels are interchangeable and contain *all* working parts, including main and drain valve seats. Think of the labor savings! Think of the added fire protection! Think of Mathews Hydrants in these days of air raids.



MATHEWS HYDRANTS
Made by R.D. WOOD Company
400 CHESTNUT STREET, PHILADELPHIA, PA.
ESTABLISHED IN 1803

THE Phipps & Bird
LABORATORY MIXER . . .



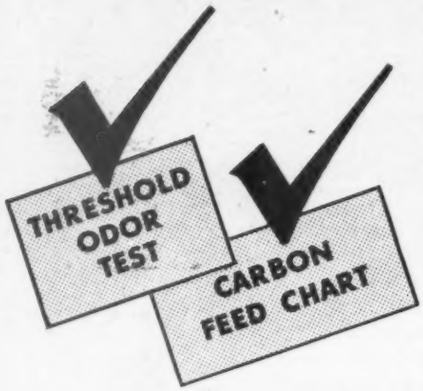
IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.

Tegul-
MINERALEAD
IMPROVED JOINTING COMPOUND
for Bell & Spigot Main

- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

The ATLAS MINERAL Products Company of Pa.
Mertztown . . . Pennsylvania

DOUBLE CHECK
for CARBON PERFORMANCE



This is no time to go by claims in buying carbon. Check performance—and be sure of maximum palatability control per dollar! Use the Threshold Odor Test. Start a Carbon Feed Chart. Be convinced that Hydrodarco is the most effective carbon for your plant.

Write for a sample of Hydrodarco, the activated carbon specially made for water treatment.

HYDRODARCO

You'll like the sift-proof bags—sealed and taped with Latex tape.

Distributing Points:
New York • Cincinnati
St. Louis • Buffalo
Chicago • Kansas City
San Francisco
Los Angeles
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ATTEND THE CONVENTION!
Chicago, Illinois — June 21 - 25

Hydrodarco—Reg. U. S. Pat. Off.

DARCO

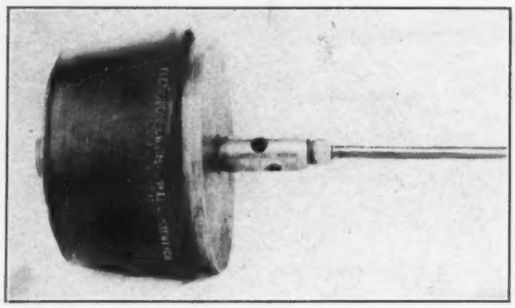
DARCO CORPORATION

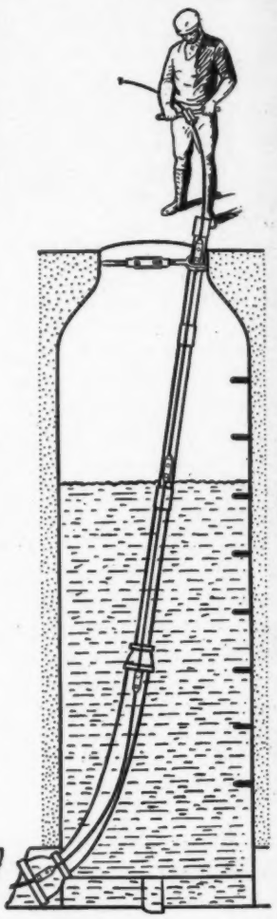
60 East 42nd St., New York, N. Y.

EQUIPMENT NEWS

"Flexible" Rubber Pipe Plug an Emergency Unit

● The Expanding Rubber Pipe Plug was originally designed for use in connection with sewer maintenance and repairs by its ability to "stopper off" sewer flow by the method indicated in the accompanying sketch. It has also been helpfully employed in making sewer surveys for location of leakage or infiltration,





introduction of industrial wastes, etc. One of its very successful applications has been its use in sand flushing by temporarily "damming" the sewer and securing scouring flow by a mere "pulling of the plug." In the same manner the plug may be employed for treating sewers with copper-sulphate for root removal and root control.

More recently this expanding seal-tight rubber plug has taken on renewed interest as a positive device for stopping flow of water or gas from broken mains, such as produced by a wash-out, earthquake or high explosive bombs. Demonstration of its effectiveness in these directions have been recently made. In the case of leaking gates on the main—above the break this plug, or its equivalent, is indispensable. Forced into the broken water or gas main, collapsed, the plug is expanded by merely turning the "Flexible" Steel Rod. In the case of broken gas mains on fire the length of rod attached proved important.

For more information concerning this interesting Expanding Rubber Plug which serves as an emergency tool as well as a valuable unit in sewer maintenance and survey work, address Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

Bituminous Coated Steel Service Pipe

● In these days of copper scarcity many water works men will be interested in the availability of cement-lined steel pipe with an exterior protective coating of bituminous enamel.

Such pipe is Hill-Hubbell's Processed Steel Service Pipe, the exterior of which is bituminous enamel coated and spirial wrapped in accord with A.W.W.A. Specification 7A-6

In sizes from ¾-inch to 1½ inches the threaded and coupled pipes used meet Federal Specification WW-P-403a.

For further information on H-H Processed Steel Service Pipe address Hill-Hubbell and Co., Cleveland, Ohio.

Turns Rust to Grease

● That is the way a new solvent for freeing rust-frozen bolts, pipes, flanges and other metal parts is described.

Utilizing a new principle the fast-acting solvent is quaranteed to free metals irrespective of how badly frozen together by corrosion, rusting, etc. It is said to work with 12 to 15 times the speed of penetrating oils.

The principle involved is the chemical action on the corrosion products to form the stearate of the metal—thereby the claim "Turns Rust to Grease." In so doing the metal proper is not affected.

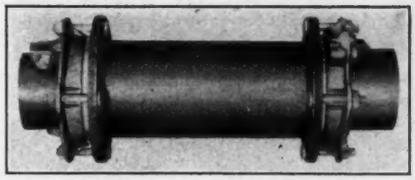
For further information and descriptive leaflet write Patrick-McDermott Co., 2704 South Hill St., Los Angeles, Calif.

New Emergency Repair Clamps

Developed by Skinner for Repairing Air Raid Damage

• Gas and water utilities in danger areas will be interested in a new Skinner unit for quickly repairing mains where a gap has been blown out by the explosion. The new clamp, which is offered as the Skinner-Seal Bomb Crater Clamp, makes a tight and lasting connection between the ends of broken mains.

Developed by the M. B. Skinner Co., as a wartime contribution, the new



adapter makes use of standard Skinner-Seal Bell Joint Clamp parts to splice in a proper length to steel pipe to fill in the gap in a broken main, with minimum delay. The illustration shows how the connection is made between main and steel pipe at each end of gap. Left end makes connection with main; right end makes connection with steel pipe. It will be noted that the flanges, welded to center tube, act as anchor rings for bolts.

Of interest, also, in connection with air raid precautions, the Skinner-Seal Split Coupling Clamp quickly repairs breaks in the main which are apt to occur for some distance on each side of the bomb crater.

According to announcement Skinner is in a position to make prompt deliveries of emergency repair equipment to gas and water utilities in all probable air raid zones.

For further information write The M. B. Skinner Co., South Bend, Indiana.

A Combination Sewer and Pipe Locator

• The Blake Sewer Locator has now been fitted for finding metal pipes also, thus making one instrument do the work that formerly required two, and resulting in saving both in first cost and subsequent operation, in addition to having less apparatus to handle the store.

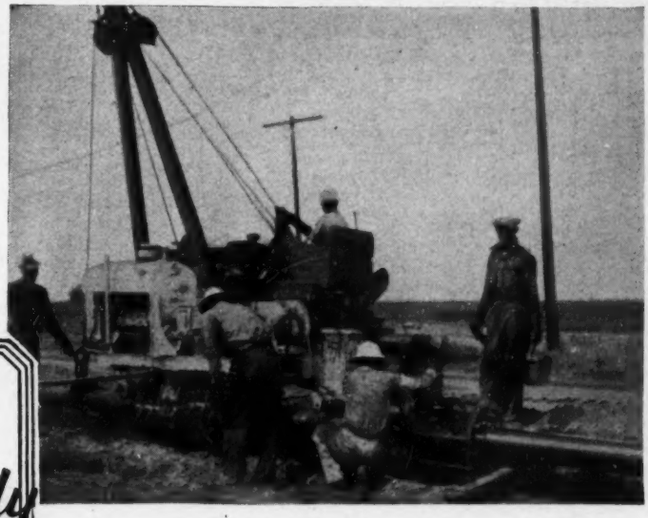
For use in metal pipe finding the battery and other electrical parts, instead of being concentrated on the transmitter, may be diverted to a lost pipe. Two reels of insulated copper wire aggregating several hundred feet in length have their inner ends always connected with battery and outer ones with spring clips for quick and reliable attachment to pipes without using pliers. After use the wires are rewound with a crank, avoiding danger of becoming tangled.

An amplifying receiving coil, phones and all that is needed for locating both pipes and sewers, other than the steel snake on a 12 in. reel, are contained in an 8½x12x12 inch case. Although sewer rods may be used for pushing the transmitter into sewers, use of the 100-foot steel snake is more convenient.

The improved Blake Sewer and Pipe Locator was originally developed as a sewer locator by an employee in the North Adams (Mass.) City Engineering Dept., and has been in use for 25 years. Now, the locator has been redesigned to serve as a combination finder for locating either sewers or water pipes.*

For a descriptive folder, which also quotes prices of this interesting combination sewer and pipe finder, address your request to Frank N. Blake, North Adams, Mass.

[*Note: In our December issue we printed an announcement of the Blake Sewer Locator. Through a misinterpretation of the pamphlet describing this locator we announced it as "The Blake Combination Sewer Locator" which could be used for locating water pipes as well as sewers. Although an error, the interest shown in such a combination pipe finder (manifest by inquiries coming in to Mr. Blake) has led to the conversion of the single use pipe finder to the improved combination unit. So, in the end, our mistake has proved a profitable one.—Ed.]



Reilly COAL TAR PRODUCTS

REILLY Pipe Coatings Are TIME-TESTED

• The best laboratory in which protective pipe coatings can be tested is "Mother Earth" herself. No other test can possibly be so positive and assuring—and it is from examinations of pipe, coated with REILLY PRIMER AND PIPE ENAMEL, and installed many years ago, that our claims for these products are made. The ability of REILLY coatings to stand up under various conditions of soil—and under wide extremes of temperature variation has been amply proved.

Ease and convenience of application and comparative low cost are other considerations which are responsible for the constantly growing preference for these products. Write for literature.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS · 500 FIFTH AVENUE, NEW YORK, N. Y. · ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

A Story—

WE DARE NOT TELL!

The scene might be in the Western Plains Country, or it might be somewhere near sea water, but regardless of location, it is a story that can't be told now. Never have such water systems been constructed. The idea is entirely new and is of major importance to the armed forces.

One fact worthy of note is that Layne was called on to drill the wells, furnish and install the pumps and to fulfill other important missions. In record time, everything has gone through on schedule. The task, though entirely new and very complicated, was handled by Layne engineers as if their usual methods had been employed.

It is characteristic of Layne to meet and conquer unusual well water supply problems. Layne engineers are trained for unforeseen eventualities. To fulfill the requirements of the Government was difficult, but promptly and satisfactorily accomplished.

Your water supply system may not involve any such highly secretive plans, but whether in the conventional or of an entirely new nature, Layne can serve you. For literature address

LAYNE & BOWLER, INC.
Memphis, Tenn.

LAYNE
PUMPS & WELL WATER SYSTEMS

Affiliated Companies

Layne-Arkansas Company.....Stuttgart, Ark.
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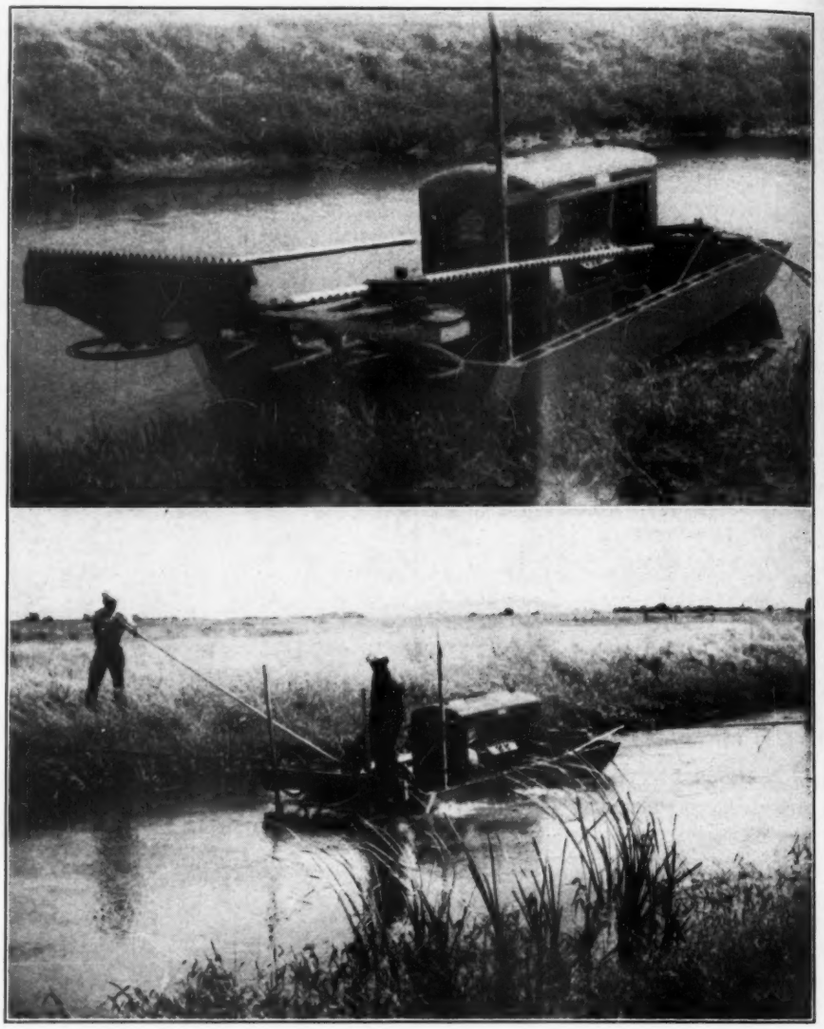
Layne-Central Co.....Memphis, Tenn.
Layne-Northern Company.....Mishawaka, Ind.
Layne-Louisiana Company.....Lake Charles, La.
Layne-New York Co.....New York City.
Layne-Northwest Company.....Milwaukee, Wis.
Layne-Ohio Company.....Columbus, Ohio
Layne-Texas Company.....Houston, Texas.
Layne-Western Company.....Kansas City, Mo.
Layne-Western Co. of Minn.....Minneapolis, Minn.
Layne-Bowler New England Corp...Boston, Mass.
International Water Supply, Ltd...London, Ont.

Under-Water Weed Cutter Compressed Air Driven



• The accompanying pictures are of an under-water weed cutter driven by compressed air supplied by a No. 60 Schramm Air Compressor.

This combination was developed for clearing irrigation canals of the Clear Lake Irrigation District, Woodlands, Calif., of aquatic weeds which obstructed free flow through these canals. Without much doubt it has application in the water-works field for clearing reservoirs or canals of such growths, which either obstruct flow or die and decay to give objectionable tastes and odors, harbor algae growths, etc. In fact, in our March issue the lead article described the control of an aquatic growth by under-water cutting with similar equipment.

From the near view of the floating cutter it can be seen that it is essentially a mowing machine blade which is driven by an air motor. The blade is adjustable as to depth of submergence to that desired. The principal value of the depth cut is that of reducing the frequency of re-cutting, in order to avoid the weeds from reaching maturity and reseeding the infested area. In this manner there will be less growth to keep down each succeeding year.

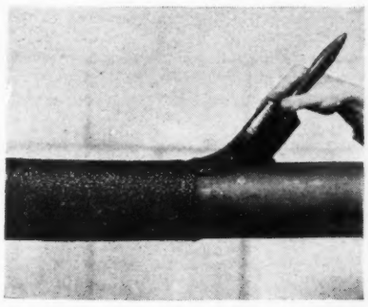
For further details concerning this "Under-Water Weed Cutter" address Com. Ward, Gen'l Mgr., Clear Lake Irrigation District, Woodlands, Calif., or to Schramm, Inc., West Chester, Pa.

BUY DEFENSE BONDS AND SAVINGS STAMPS

New Plastic Cork Coating for Stopping Condensation Drip

• After three years of research and tests under all conditions, the J. W. Mortell Company, Kankakee, Illinois, announce "No Drip," an improved plastic cork coating that stops dripping from condensation or sweating of pipes, walls, ceilings, tanks, air-ducts, etc. Applied to gas piping and air pipes at sewage plants it will prevent internal condensation, or the production of the frost ring in exposed lines in Winter.

The first product of this kind introduced by Mortell for the same purpose was more limited in its use, because it required power spray equipment to apply it, but "No Drip" has a greatly enlarged field, due to its easier and quicker method of application by using an ordinary paint brush, or a whisk broom.



In a single application, without use of any primer, "No Drip" is spread ¼-inch thick over any metal, concrete, brick, plaster, tile, wood, composition, galvanized or painted surfaces, corners, angles or corrugated ceilings. "No Drip," after its "set," can be painted any color desired.

Complete information and prices are contained in a new illustrated circular showing interesting uses of "No Drip," and a copy will be sent on request to J. W. Mortell Co., Kankakee, Ill.

ECONOMICAL AERATION
AT VARYING FLOW RATES

One of two Multi-Capacity Blowers at Lansing, Mich. Capacity 4000/2667/1333 CFM; 175 H.P.; 575 R.P.M.; direct motor connection.

Roots-Connersville Multi-Capacity Aerating Blowers, driven from constant speed motors, offer you the capacity advantages of THREE separate blowers, plus the economy advantages of a compact ONE-UNIT installation.

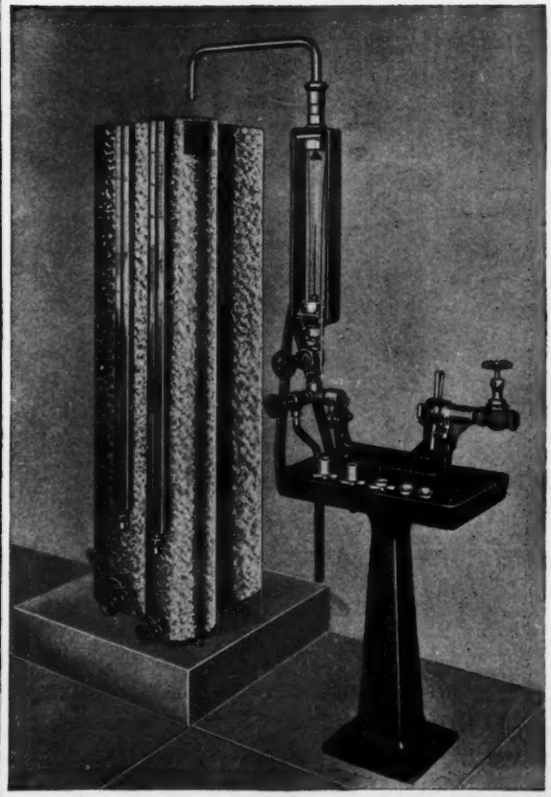
The housing is divided into two sections of different size, each having a set of impellers. By opening one of the by-pass valves, either set of impellers can be unloaded completely, thus giving three efficient capacity points for economical aeration at varying flow rates.

Our delivery commitments are lengthening—therefore, we ask your understanding and cooperation if your requirements cannot be shipped as promptly as in the past.

All Out for Victory

ROOTS - CONNERSVILLE BLOWER CORPORATION
204 Mount Avenue Connersville, Ind.

Roots Connersville Since 1854 MULTI-CAPACITY Aerating BLOWERS



Meter TESTER and TANK

Ford Meter Testing Equipment provides maximum convenience in the three essentials: clamping of meter in testing position; regulating the test flow; and computing the accuracy of the meter. Testing Machines and Calibrated Tanks are made in five standard sizes. Special machines have been made for scores of large meter shops.

All Ford Testers can be provided with the Testerate Indicator.

Tell us your testing problems.

FORD METER BOX CO.
WABASH, IND.

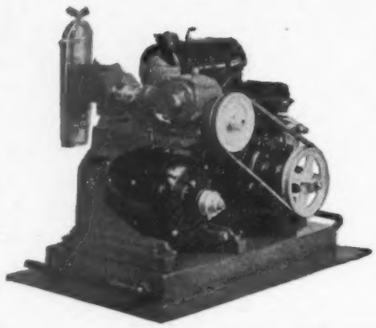
★ ★

FOR EMERGENCY STERILIZATION

USE

The WILSON PULSAFEEDER

In the present emergency the nation realizes that the safeguarding of our potable water supplies is of prime importance in the protection of public health. Authorities everywhere agree that sterilization by chlorine is the most practical and effective insurance against waterborne disease,—providing that the method used or the machine employed is positive, dependable and easy to control. DESIGNED FOR EMERGENCY DUTY, THIS "PULSAFEEDER" POSSESSES THESE OUTSTANDING FEATURES:



★ PROVIDES PORTABLE, EMERGENCY CHLORINATION WITH BOTH GASOLINE AND ELECTRIC MOTOR DRIVE.
★ CAPACITY UP TO 600 POUNDS OF CHLORINE PER 24 HOURS.
★ FEEDS INTO PRESSURE MAINS UP TO 200 POUNDS PER SQUARE INCH.
★ HANDLES CONCENTRATED HYPOCHLORITES—SLUDGE AND ALL.*
★ ELIMINATES PACKING GLANDS, AND MECHANICALLY OSCILLATED DIAPHRAGMS.
★ AVAILABLE AS ILLUSTRATED WITH CARRYING HANDLES, OR IN TRAILER TYPE.

*The "PULSAFEEDER" is the only hypo-chlorinator made that feeds calcium hypo-chlorite—sludge and all, or concentrated sodium hypochlorite, leaving no waste whatever.

Write for Bulletin No. 1-1192.

WILSON CHEMICAL FEEDERS, INC.

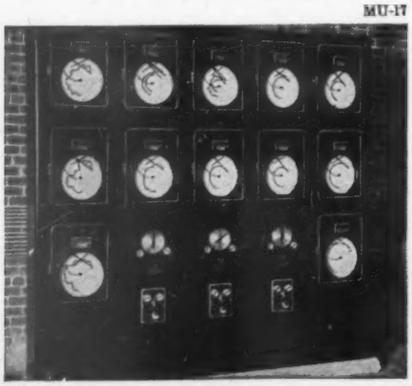
Engineering Offices in Principal Cities — BUFFALO, N. Y.

THE *Bailey Synchro-Meter* GIVES YOU *Flexibility* IN METERING APPLICATIONS

● This meter panel includes both direct mechanically operated Fluid Meters and Bailey Synchro-Meters, which are electrically operated by remote transmitters.

Wherever you have need for a central meter panel incorporating both mechanically and electrically operated Fluid Meters, it is possible to maintain uniformity and neatness by employing this system of transmitting meter and recorder readings.

MU-17



Readings of flow, pressure, temperature, liquid level and other factors are accurately and quickly transmitted from out-of-the-way places to the receiving indicator, recorder or integrator by the Bailey Synchro-Meter.

This electrical mechanism which is completely described and illustrated in Bulletin No. 194-A, can also be used to eliminate the necessity of running high pressure piping up to meter and control panels.

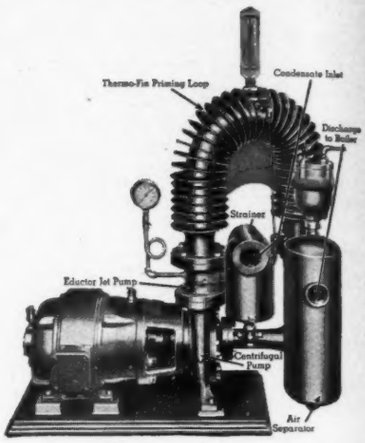
Write for your copy of this new Bulletin.

BAILEY METER COMPANY

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL

High-Pressure Condensate Return System



● The essential engineering features of the Cochrane-Becker high-pressure condensate return system, announced by Cochrane Corporation, are that its educator principle of operation insures thorough condensate and air removal from process apparatus making increased production possible by maintenance of uniformly high temperatures. Then, after expulsion of the air from the closed circuit, the condensate is returned to the boiler at temperatures close to that of process pressure without flash loss, with remarkable fuel savings being claimed.

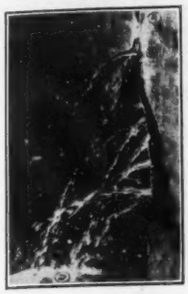
The specially-designed centrifugal pump draws water from the thermo-fin priming loop and discharges it as a high velocity jet through the jet pump nozzle. This jet, striping the returned hot condensate, induces condensate flow through the mixing tube into the thermo-fin priming loop. The additional volume of the returned condensate introduced into the constantly filled loop results in the discharge of an equal volume through the air separator to the boiler.

The closed circuit from the boiler, through the process equipment, and back to the boiler, results in quicker and more uniform heating hence increased production and improved quality. At the same time flash loss is eliminated providing 1 per cent fuel saving for each 11-degree temperature gain. For further technical information, write Cochrane Corporation, Philadlephia, Pa.

Multi-Point pH Recorder

● The new Multi-Point pH Recorder of Cambridge Instrument Co. produces on a single chart simultaneous records of pH at separate and independent points in a fluid-flow system. It can be employed to provide a continuous "before and after" picture of pH that enables the operator to continuously see the effectiveness of the process or treatment in use. It also guides the operator to attain best results.

The photograph was made from an



WATERPLUG

1. For control of water pressure when running or seeping through cracks and other defects in masonry.
2. For caulking and sealing around pipes or other appliances which pierce masonry walls of tanks, sludge basins or foundations.
3. WATERPLUG is prepared ready for use by the addition of mixing water only. It hardens quickly and is permanent.
4. WATERPLUG protects lead, copper, brass and other pipes, subject to corrosion from free alkali in cements.
5. Troublesome water problems can be solved quickly and permanently.

For free advice and methods of correction, please address

Standard Dry Wall Products, Inc.
BOX X NEW EAGLE, PENNA.

LEADITE

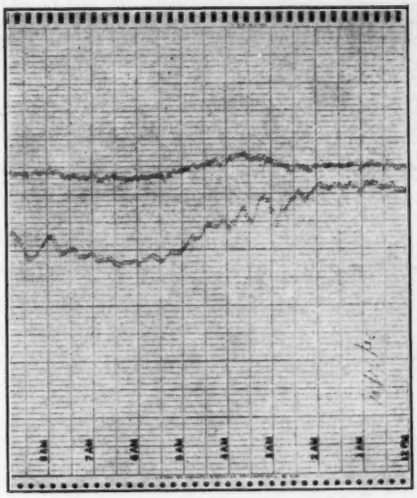
The Pioneer Self-Caulking Material for C. I. Pipe

Even where vibration is severe . . .

LEADITE has been used with satisfaction, making a good tight joint that improves with age! For more than 40 years, engineers and water works men have proved the dependability of Leadite under most all conditions of bell and spigot water main construction.

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking

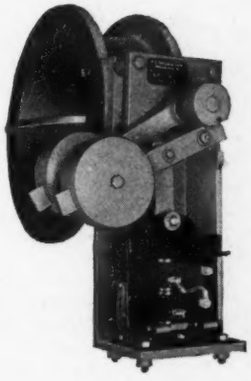


actual record, each horizontal line representing a change of 0.1 in pH-value and the whole scale covers a pH range of 3 to 11. The two lines indicate the effectiveness of adjustment of pH to maintain an even pH in the adjusted water, sewage, sludge, etc.

The new instrument which provides these records, although conventional in appearance, incorporates an outstanding advance in circuit design that permits installation of the measuring electrodes at separate and independent sampling points in the plant. They are connected electrically to the recorder which may be a considerable distance away.

For further information address the Cambridge Instrument Co., 3732 Grand Central Terminal, New York City.

Solenoid Operated Butterfly Valve for "Blitzkriek" Service



● A recent application of the inexpensive butterfly valve for emergency duty has been announced by R-S Products Corporation. The feature of this emergency main line shut-off valve is its quick, automatic action. Solenoid operated, the valve provides two-position control in either automatic opening or wedge-tight shut-off. In an open position the butterfly vane is held open by the magnetic action of the solenoid. On a pump discharge line if the elec-

·1879·

ROSS

·AUTOMATIC VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.

REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

Know What This Is?

Right! It is a Sparling Meter for direct-action Totalization, ready to install in a 6-inch bell & spigot line—list price, $250.

Consistent accuracy, durability, and low head-pressure loss are important reasons for choosing a Sparling. Indicating and Recording equipment is optional.

Sparling Meters are made for all mainlines from two-inch up—Flanged, Bell & Spigot, Threaded or Welded.

New 1942 Bulletin No. 308 will be sent upon request.

SPARLING

Box 3277, Terminal Annex..LOS ANGELES
3104 S. Michigan Ave.....CHICAGO
622 Broadway .....CINCINNATI
101 Park Avenue.....NEW YORK

AER-O-MIX
AERATOR – MIXER

Down-Draft Type
MECHANICAL
SEWAGE AERATORS

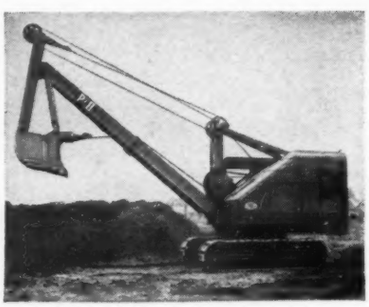
Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.

VOGT MFG. CO.
INCORPORATED
P. O. Box 1122 Louisville, Ky.

tric power is shut off or fails for any reason the trigger is tripped and the counterweight closes the butterfly vane wedge-tight against the body of the valve. In the same manner its operation by remote control will shut off a water main or a gas line discharging through a break in the line. It will remain closed until it is re-set by hand; therefore, it can be opened or can be closed by remote or automatic control, but not both.

For a more complete description of the valve, write R-S Products Corporation, 4530 Germantown Ave., Philadelphia, Penna.

New Trench Hoe Designed for Faster Production



Incorporating many refinements of design from crawlers to boom, the new P&H 655-A Trench Hoe just introduced by Harnischfeger Corporation points to improved trench hoe performance in its range. Fast digging with great ease is accomplished by newly developed and powerful gear-driven booster device with positive primary chain drive. This auxiliary drum unit also speeds dipper reversing action and provides greater smoothness and accuracy in controlling the dipper.

Also interesting is the working range of the new P&H Trench Hoe, which is equipped with a 1½-yd. struck measure dipper. Its digging depth is 22 ft., it has a 37-ft. reach and a dumping height of 16 ft. A low pressure hydraulic system, of the same type so successfully employed in the automotive industry, is used to control the 655-A.

Typical of P&H design, this new Trench Hoe is of all-welded alloy steel construction throughout, and in every detail reflects simplicity and extra ruggedness. For complete information on this new model write Harnischfeger Corp., Milwaukee, Wis.

BUY DEFENSE BONDS

AND SAVINGS STAMPS

AERO FILTERS

• • • •

Low Initial Cost

Low Operating Cost

◆

High Capacity

High Degree of Purification

Raindrop Application

◆

Disc and Rotary Distributors

●

"Results Obtained by Excellent Distribution and *Not by Re-circulation.*"

• • •

LAKESIDE ENGINEERING CORP.

222 W. Adams St. Chicago, Ill.

NO DELAYS

●

Ample stocks of FER-RI-FLOC for Water and Sewage Treatment are available for immediate delivery. Wire, write or 'phone us your requirements.

Ferri-Floc
TC
FERRIC SULPHATE

Tennessee Corporation
ATLANTA, GA. LOCKLAND, OHIO

WITH THE MANUFACTURERS

B. W. Clark Named Westinghouse Sales Head

• B. W. Clark, who a year ago became vice president in charge of the Westinghouse Electric and Mfg. Co.'s merchandising division, has now been elevated to vice president in charge of sales of the Company. He succeeds Ralph Kelly, who resigned to become executive vice president of the Baldwin Locomotive Works.

Mr. Clark, in addition to supervising the sale of Westinghouse apparatus, will be responsible for coordinating all sales of the Westinghouse Co. and its numerous subsidiaries. At the same time he continues as president of the Westinghouse Electric Supply Co., a position which he has held since 1937.

Mr. Clark was born in Gagetown, New Brunswick, Canada, but spent his early years in Adrian, Michigan, and attended the University of Michigan. For the past 35 years he has been engaged in electrical wholesaling and merchandising.

In 1925 Mr. Clark joined the Westinghouse Electric Supply Co., and became successively its general manager, vice president and director, and in 1937 was elected president. In January 1941 Mr. Clark was elected vice president of the parent Westinghouse Electric and Mfg. Co.

Mathieson Announces Plans for New Ammonia Plant

• Plans for the immediate erection of a plant that will substantially increase America's supply of ammonia and its derivatives have been announced by E. M. Allen, president of the Mathieson Alkali Works, Inc., New York.

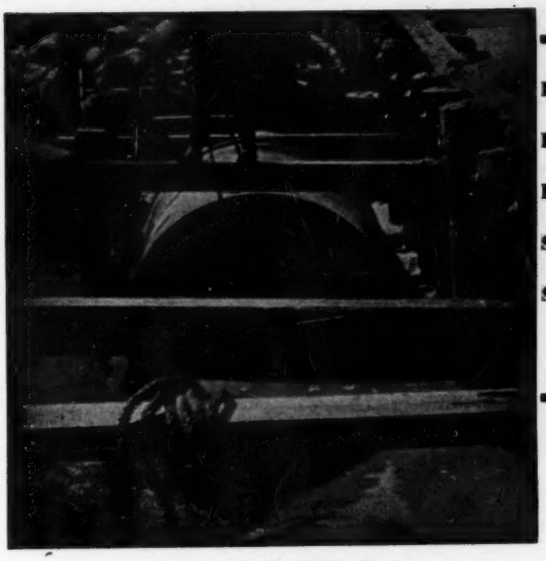
In accordance with the terms of a contract that has just been signed, the new plant will be financed by the Defense Plant Corporation and will be erected and operated under lease by Mathieson.

The ammonia will be produced synthetically by combining hydrogen with nitrogen obtained from the air, through the use of a modification of existing methods.

Fairbanks-Morse Has Largest Year in Its History

• In its annual report to stockholders, Fairbanks, Morse & Co. report 1941 net sales of $48,520,958, largest in the company's history. The net profit for the year after taxes and a special reserve of $750,000 was $2,920,618 or $4.87 per share. largest since 1925. On April 1st stockholders received an extra dividend. Taxes for 1941 amounted to $11.40 per share as compared with $5.59 in the previous year.

The company closed the year with a cash balance of $5,156,234, largest in company's history.



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Peerless Pump Acquires Sterling Pump Corp.

● Completing another phase of progressive plant expansion, Peerless Pump Division of the Food Machinery Corporation of Los Angeles, Calif., and Canton, Ohio, announces acquisition of the Sterling Pump Corporation, with plants in Hamilton, Ohio, and Stockton, Calif.

Peerless will consolidate the Sterling plant at Hamilton with the new Peerless manufacturing plant at Canton, Ohio. Sterling's Stockton plant will be merged with the John Bean Manufacturing Co., Division of the Food Machinery Corporation, San Jose, Calif.

The widely known line of deep well turbine pumps, jet pumps and small domestic pumps, manufactured by Sterling for the past 25 years, will fit into and complement Peerless' complete line of deep well turbine pumps, "Hi-Lift" pumps, and "Hydro-Foil" (propeller type) pumps.

Production engineers at Peerless' Canton plant have already been assigned the job of designing a straight line assembly department. This department will be utilized for the speed manufacture of Sterling's small products line.

In connection with Sterling's purchase by Peerless, it was indicated by Vernon Elder, Vice-President and General Manager of Peerless, that an unusual development in pump design will soon be announced. It is the opinion of Mr. Elder and Peerless engineers that this development bids fair to revolutionize one of the larger markets in the pumping field. Details are promised in the very near future.

Personnel affected by the purchase of Sterling by Peerless Pump is as follows: H. J. McKenzie, President of Sterling Pump Corp., joins the Peerless Pump Division as assistant to Mr. Edler; Fred Jones, manager of Sterling's New York office, will continue with Peerless; and Jack Wade, Sterling's Chief Engineer, will be in charge of developments at the Canton Plant.

Bailey Meter Expands Field Engineering Staff

● Increased demands for metering and control equipment has necessitated an enlargement of Bailey Meter Company's Field Engineering Staff. The following Engineers have recently been assigned to field duty: J. T. Elder and J. E. Wood to Atlanta; J. E. Luppold to Seattle; E. P. Nye to Buffalo; R. B. Pogue to Milwaukee; W. D. Hilborn to Houston; J. J. Haslam to Kansas City; J. J. Wilber to Cleveland; C. E. Hicks to New York; J. R. Powell to Pittsburgh; S. G. Dukelow to Denver; R. V. Johnson to Chicago; W. D. Robinson to Boston; and C. C. Holtzman to Philadelphia.

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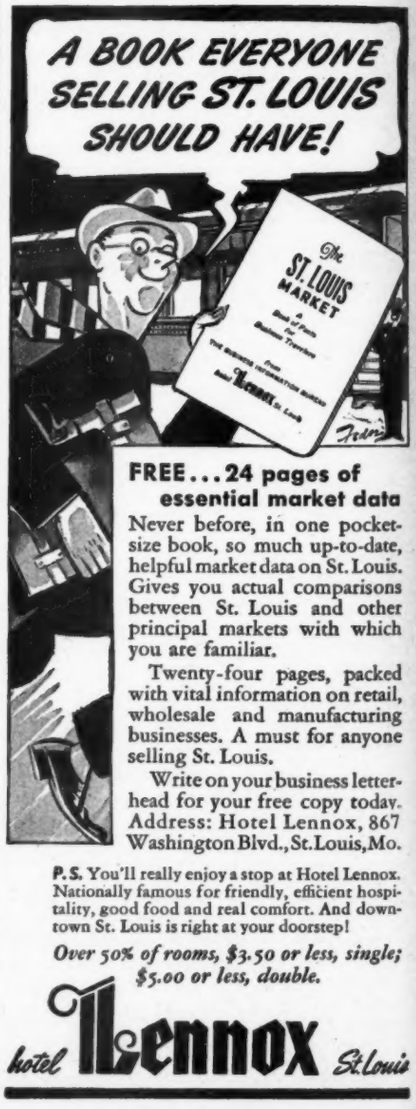

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E. H. Brown Made Head of Engineering and Development by Allis-Chalmers

● Edwin H. Brown has been elected a vice president of the Allis-Chalmers Manufacturing Co., in charge of engineering and development.

Before assuming the new post, in which he will correlate all engineering activities and the development of new products, Mr. Brown was manager and chief engineer of the engine and condenser department for seven years.

Immediately after obtaining his engineering degree from the University of Nebraska in 1906, Mr. Brown entered the Allis-Chalmers training course for graduate engineers. He became head of the engine and condenser section in 1935.

The administration of the engine and condenser department has been taken over by M. L. Carson, sales engineer.

Cochrane Appoints Power Specialty Co. as Texas Representatives

● Power Specialty Co. of Houston, Texas, has been appointed to represent the Cochrane Corporation (Philadelphia) in southeastern Texas for the sale, installation, and service of Cochrane meters. In addition to handling the Cochrane meter line, the Power Specialty Co. also handles the products of Centrifix Corp., Erie City Iron Works, Hays Corp., J. E. Lonergan Co., and the Lummus Co.

M. S. A. Opens New Canadian Headquarters

● Greatly enlarging its Canadian service, Mine Safety Appliances Company of Canada, Ltd., announces acquisition of a new building conveniently located at 139 Kendal Avenue, Toronto, where a broad line of approved safety equipment will be quickly available to industry and municipalities.

The Canadian-managed and staffed subsidiary of Mine Safety Appliances Company of Pittsburgh will conduct the manufacture and assembly of certain M. S. A. products while stocking all important items made by the parent company, generally conceded to be the largest commercial producer of approved safety equipment in the world.

Mine Safety Appliances Company of Canada., Ltd., operates district offices in Montreal, New Glasgow, and Sydney, Nova Scotia. Well known in the Canadian safety equipment field is the company's general manager, Mr. R. Morris, who will make his headquarters in Toronto.

A new General Catalogue of Industrial Safety Equipment has just been prepared by this company. Copies may be obtained by writing direct to Mine Safety Appliances Company of Canada, Ltd., 139 Kendal Avenue, Toronto, or to the parent company in Pittsburgh, Pa.

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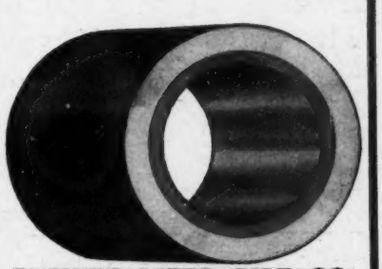

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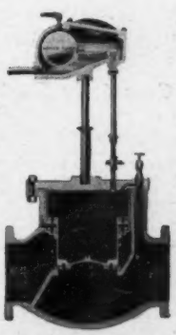

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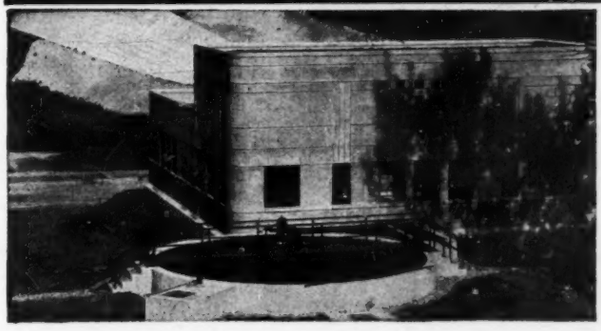

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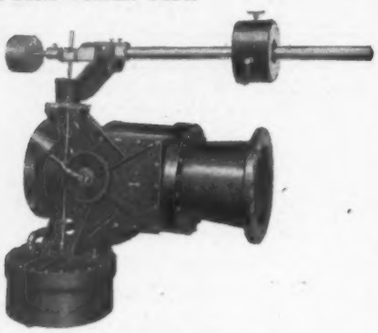

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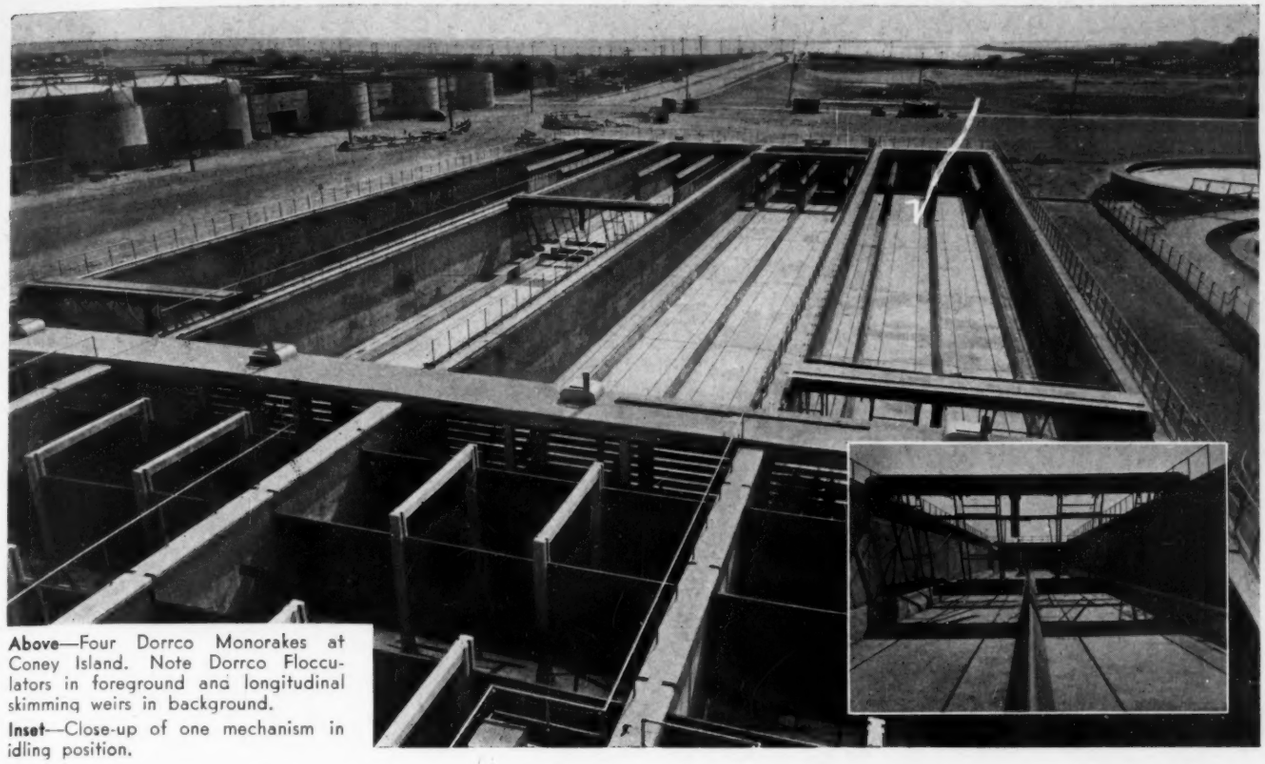
*Advertisers with * were represented in the June, 1941, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on any of their products.

DORRCO MONORAKES



Above—Four Dorrco Monorakes at Coney Island. Note Dorrco Flocculators in foreground and longitudinal skimming weirs in background.

Inset—Close-up of one mechanism in idling position.

FOR CONEY ISLAND'S EXPANDING PLANT

ADVANTAGES

All Lengths—Widths up to 3 times normal.

Automatic Overload Relief
Rake blades swing upwards automatically if overload is encountered, but continue to rake at full capacity until normal conditions are re-established.

No Submerged Bearings
All bearings and metal to metal wearing parts are above the water level, convenient for inspection and lubrication.

Long Life Without Repair
Several in operation for 4 years with no replacement of parts.

Skimming in Either Direction
Skimmer can be supplied to skim longitudinally either toward or away from influent.

Single Drive for Multiple Units
Under certain conditions it is feasible to drive two or more Monorakes from a single motor-drive unit.

★ The capacity of the Coney Island Sewage Treatment Works has just been doubled to 70 M.G.D. to serve the Coney Island area and a portion of Brooklyn.

Flocculation and sedimentation are carried out in four 38 ft. wide by 250 ft. long rectangular basins equipped with Dorrco Flocculators and Monorakes. In addition, four new Dorrco Trash Racks, four Dorrco Bar Screens and three Dorr Detritors have been installed to protect both the old and new sections.

The Dorrco Monorake is the ideal solution to the problem of a mechanism for rectangular tanks. It makes no difference whether the basins are already installed or local conditions dictate their use. Or whether they are large or small. For the Monorake is readily adaptable to all sizes and types.

★ ★ ★ ★ ★

Because of this extreme adaptability, the Monorake is a natural for expansions on Defense Public Works projects made necessary by the present shifting of defense workers.

★ ★ ★ ★ ★

May we send you a bulletin describing the Monorake in detail?

DORRCO

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"For the war production program has produced one of the greatest movements of population in our history . . ."
—NEW YORK TIMES

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② BUDGET PROTECTION

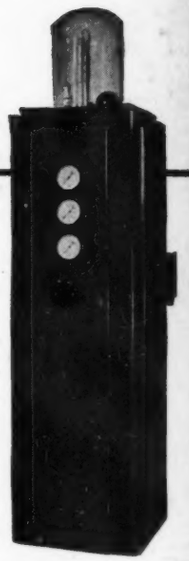
Tomorrow

As your s... the dem... and extra s... de-mands ... are sure to ar... the hig... ex ... ahead of us. Wh...ever possible, your current sewage treatment investment to meet extraordinary conditions should be aimed at *highly flexible* facilities. The need is for equipment that (1) solves the immediate problem quickly and completely, (2) improves operating efficiency under ordinary conditions and thus pays long-term peace time dividends.

Modern Wallace & Tiernan chlori...ting equipment can help you greatly on both counts. Closely controlled prechlorination helps meet peak loads, improves filter operation, overcomes septic sewage, scum and odors. Effluent chlorination gives greater health protection and even permits safe by-passing when loads are temporarily too great for the plant.

Moreover, the W&T equipment you install now will continue to eliminate complaints and reduce operating costs in after years. You are reducing, rather than increasing, future maintenace expense when you make this investment.

SA-128



Your local Wallace & Tiernan Representative is prepared to advise and assist you in making the most effective use of present facilities with the aid of chlorination . . . in getting greater effectiveness from every pound of chlorine you buy. Call him today, or write direct for free bulletin: "Chlorination for Increased Flexibility in Sewage Plant Operation".

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